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ARCHIVES OF OTOLARYNGOLOGY

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BRONCHIAL ASTHMA

CLINICAL STUDIES AND OBSERVATIONS IN THREE HUNDRED AND FOURTEEN CASES *

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CLEVELAND

Asthma has existed as a clinical entity as long as medicine itself. One can read the leading textbooks of twenty years ago, those of today and the vast amount of literature accumulated during the recent years and immediately be struck by the fact that anything is liable to cause an attack of asthma, and conversely, that anything is liable to cure it. No subject shows as many vagaries.

Because of a better classification as to etiology, considerable progress has been made in the last few years as the result of the scientific researches and clinical investigations of a few close observers. This work has been augmented and made possible largely by a review and analysis of cases. Little by little there has come a gradual common understanding because each man interested in this subject has reported his impressions, observations and results in the diagnosis and treatment for this disease. My object in this paper is to confirm, and perhaps add to, some of the former series reported.

This review includes 314 cases of bronchial asthma which have been registered in the Cleveland Clinic for examination and treatment. A complete history was taken in each case and physical examination made by a trained internist, who then referred the patient to the special departments indicated by the findings in the examination. In the routine laboratory examination, complete blood count, blood sugar estimation, urinalysis, complement-fixation test and skin test for allergens were made in each case. A flat roentgenogram of the chest was taken in all cases except those in which there was a positive history of some allergy. From this examination it was possible to rule out any gross pathologic condition in the lungs, and when suspicious areas were found they were rechecked by a stereoscopic roentgen exami-

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nation. Conditions relative to the heart were not rechecked by further roentgenograms as the chief in this department is of the opinion that a flat film reveals about as much information as any other type of picture.

The skin tests were made by one person, the scratch method being used. The following proteins were employed routinely: goose, duck, rabbit, cat, dog, horse dander, cotton, flax, silk, wool, orris root, kapok, eggs, milk, wheat, oats, white fish, beef, chicken, lamb, pork, veal, salmon, peach, beet, asparagus, carrot, cabbage, cauliflower, celery, bean, lettuce, onion, potato, pea, spinach, grapefruit, orange, pineapple, apricot, banana, prunes, tomato, tea, coffee, almond, cantaloupe, apple, June grass, timothy, red top, orchard grass, ragweed (S), ragweed giant, plantain and rye grass.

Other proteins were used when the history indicated that they might be of value. In a large number of cases in which the first skin series were negative, repeated examinations were made. Intracutaneous examinations were not made in any of this series.

In addition to the general examination, a history relative to the ears, nose and throat was taken, and examination made in the otolaryngologic department. The diagnoses will be recorded in the study under various headings.

The purpose in describing the routine examination of patients suffering from asthma is to furnish the reader with full information regarding our method of arriving at a diagnosis in any given case. By working out the problem in this fashion, we were able to eliminate those cases in which the patient suffered from conditions causing asthma-like symptoms, such as heart disease, hypertension, arteriosclerosis, chronic pulmonary tuberculosis, bronchiectasis, emphysema, fibrosis of the lungs, malignancy or any obstructing lesion that interfered with oxygenation. In this study I am interested primarily in the asthmatic patient who belongs to the allergic and infectious group; however, all cases of asthma are analyzed.

TYPES OF ASTHMA

Our cases were classified as intrinsic and extrinsic according to the nature of the cause. As Rackemann [1] pointed out, these two types can be subdivided into numerous groups. Thus causes of the extrinsic type of asthma include pollen, animal danders, foods and other substances. The intrinsic causes in our cases were all infectious in type, the cause being confirmed by special examinations of the nose and

1. Rackemann, Francis: Studies in Asthma: II. An Analysis of Two Hundred and Thirteen Cases in Which the Patients Were Relieved for More Than Two Years, Arch. Int. Med. **41**:346 (March) 1928.

throat or by evidence found in other examinations. Asthma due to an intrinsic cause no doubt is the most difficult to identify. Many writers give fairly good evidence that a great many of these cases of asthma are probably due to external causes. Foremost is Cooke,[2] who has brought forward the house dust problem and who was able to show a large group of cases in which asthma was thought to be due to intrinsic causes but the patient reacted to house dust material. The pollen group is being extended by such workers as Duke[3] and Rowe,[4] who are improving their technic of skin examinations. They offer a convincing argument in the fact that patients who are sensitive to pollens are relieved by higher altitudes and change of environment, which on the face of it does appear to favor their contention. Their conclusions have not been confirmed by other workers, the points of view of many of whom are just as convincing. Rackemann and King,[5] after a considerable amount of work in the outpatient department of the Massachusetts General Hospital, using the technic for collecting house dust and testing the patient with it, concluded that the interpretation of the skin test varied in different clinics, which accounted for the variation in the reports. These authors report that 36 per cent of all asthmatic persons show a skin reaction positive in some degree to house dust, while circumstantial evidence often points to a respiratory infection rather than exposure to dust as a cause of the attack. Treatment of 95 asthmatic persons with dust extracts produced good results in only 15, and some of these had other treatment at the same time. Large doses of strong extracts have not been given in the Cleveland Clinic, and we have not seen general reactions with urticaria or asthma following treatment with dusts. Rackemann and King finally concluded that a diagnosis of bacterial asthma is clinically adequate, and that indefinite skin tests may represent some unknown characteristic of the asthmatic patient rather than a specific hypersensitiveness which is clinically important. That higher altitudes and change of environment give relief because there is freedom from exposure to the offending protein has not been proved to great satisfaction. That relief of symptoms usually occurs is true, but as

2. Cooke, Robert: New Etiologic Factors in Bronchial Asthma, J. Immunol. **7**:147, 1922.

3. Duke, W. W.: Asthma, Hay Fever, Urticaria and Allied Manifestations of Allergy, St. Louis, C. V. Mosby Company, 1925.

4. Rowe, A. H.: Pollen Counts in the East Bay Region with Studies on the Morphology of Pollen.

5. Rackemann, Francis; and King, Donald: Bronchial Asthma: The Role Played by House Dust and by Bacteria, Boston M. & S. J. **195**:347, 1921.

Beckman [6] pointed out the allergic state is one in which the patient has a tendency to store up reserve alkali or to neutralize too rapidly and too effectively the acid substances that are constantly being liberated into the blood stream during the course of normal metabolism, the body being essentially an acid-producing organism. The tendency of the allergic person is toward alkalosis rather than acidosis. Reasoning from these facts, Beckman cited the fact that any person, whether he is allergic or not, tends to improve on a sea voyage. Oriel,[7] of the Canadian Pacific Steamship Lines, explained seasickness as follows:

> (*a*) Labyrinthmic disturbances, if present, do not give rise to nystagmus or to alteration in labyrinthmic tests, (*b*) autosuggestion is not wholly responsible as there is a distinct metabolic upset found in the prevomiting stage, which is shown by hyperglycemia followed by hypoglycemia, increased ammonia excretion, and presence of acidosis in the urine, (*c*) administration of dextroses causes diuresis, ablation of acetonuria and a fall in the ammonia excretion, resulting clinically in the relief of symptoms.

It is concluded from this that in seasick people there is a pronounced acidosis, and in voyagers not sick there is nevertheless a metabolic disturbance in the direction of acidosis. This acidotic factor in life at sea was long ago recognized by experienced ship's surgeons, who are wont empirically to advise passengers to eat exclusively of vegetables and fruits (substances with an alkaline ash) if they would avoid becoming sick.

Beckman's point of view on altitudes is based on the same line of thought. Both types of allergic persons (whether pollen or some other agent is the cause) experience the same relief. Hurst,[8] chairman of the Asthma Research Council, London, made the interesting statement that sufferers who are sensitive to cats in the lowlands of England are not affected by a cat in Switzerland. Henderson showed that in the adjustment to altitude the blood alkali of people in Colorado is normally lower than in inhabitants of the sea coast. The condition is not acidotic, but acapnial, i. e., the loss of carbon dioxide through the augmentation of respiration is compensated by excretion of the excess alkali left in the blood; as a result, the individual does not become acidotic but he does lose alkali. In other words, patients sent to the Rockies or to the Alps to obtain relief from asthma are being sent to regions where they undergo a depletion of the alkali reserve.

As I have stated, the intrinsic group includes those cases of asthma in which the cause is inside the body. Rackemann makes quite a dis-

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6. Beckman, Harry: Allergy and the Acid-Base Balance, J. A. M. A. **95**: 1582 (Nov. 22) 1930.

7. Oriel, G. H.: Lancet **2**:811 (Oct. 15) 1927.

8. Hurst, A. F.: Asthma Research, J. A. M. A. **93**:1898 (Dec. 14) 1929.

tinction between the bacterial group and what he calls "reflex asthma," but he stated that in all cases there are foci of infection either in the nose and throat or elsewhere, as is proved by the fact that improvement follows treatment of the infection. It is my opinion that in cases in which an active infectious process is present and the patient has asthma, the disease should be classified under the infectious type. However, it is impossible to explain the reflex action satisfactorily. It is easy to apply many plausible theories, but difficult to demonstrate any scientific facts to account for the condition. I might as well try to discuss or explain the cause of respiration.

In the group of cases classified as belonging to the infectious type, we have been able to demonstrate that the infection and the asthma were present simultaneously.

Miscellaneous unclassified cases comprised the third group. In these cases we were unable to demonstrate any specific cause for the asthma other than the lack of proper oxygenation, due to some associated disease which will be discussed in more detail later.

AGE AND SEX

In reviewing the case histories in this series, the age given is that of the onset of the asthma as recorded in the case history.

As will be noted most of the cases were in adults and the majority in males. Sixty-one and two-tenths per cent of the cases occurring during the first decade were in males and 38.7 per cent in females. Bray[9] found 72.5 per cent in males and 27.5 per cent in females. Among 90 cases of asthma in children, Rackemann found 73 per cent in males and 27 per cent in females, while among 75 cases Comby noted 57 per cent in males and 43 per cent in females. In Cooke's series of 135 cases in children, 60 per cent were in males and 40 per cent in females. Peshkin reported 65 per cent in males and 35 per cent in females. From these observations it is evident that during the first decade the incidence of asthma in males is high as compared with that in females, the ratio ranging between 2:1 and 3:1.

Above 10 years of age in our series, 55.1 per cent of the cases were in males and 44.9 per cent in females. The greatest difference in sex incidence was above the age of 40, the percentage in males being 62.5 as compared with 37.5 in females. Walker,[10] in 400 cases of asthma in adults, found 49.5 per cent in males and 50.5 per cent in females. Bullen,[11] in 265 cases, found 49.4 per cent in males and 50.6 per cent in

9. Bray, George: Brit. M. J. **1**:384 (March 1) 1930.

10. Walker, I. C.: Bronchial Asthma: A Clinical Study of 400 Patients, Boston M. & S. J. **179**:288, 1918.

11. Bullen, S.: New York State J. Med. **29**:545, 1929.

females. Cooke, in 350 cases, found 50.9 per cent in males and 49.1 per cent in females at all ages, but 41.3 per cent in males and 58.7 per cent in females from puberty to menopause.

Table 1 shows also the type of asthma relative to age and sex in our series. During the first decade there is a marked difference between the incidence of the extrinsic and the intrinsic types, a ratio of 3 extrinsic to 1 intrinsic. The same relation as to sex incidence exists in the extrinsic group in this decade as in that of all types combined—the ratio of males to females in the total number being about 1.3:1. In the intrinsic group the females predominate, the ratio being about 2:1. Peshkin [12] found that the onset of asthma is more frequent at the age of 1 year than at any other; that as the children approach the age of 13 the allergic and nonallergic incidences which run parallel seem to become progressively less;

TABLE 1.—*Classification as to Age of Onset, Type of Asthma and Sex*

Age	Total Males	Total Females	Extrinsic		Intrinsic		Unclassified	
			Male	Female	Male	Female	Male	Female
10	41	26	38	19	3	7	0	0
20	14	12	13	9	1	3	0	0
30	21	29	16	20	3	8	2	1
40	26	25	10	8	14	10	2	7
50	45	28	19	13	16	7	10	8
60	23	12	6	1	9	6	8	5
70	7	4	0	0	2	0	5	4
80	0	1	0	0	0	1	0	0
Total	177	137	102	70	48	42	27	25

that during the first five years of life the onset of asthma occurs in 78 per cent of the protein sensitive and in 72 per cent of the nonprotein sensitive groups; that in the second five years of age the onset of asthma occurs in 21 and 24 per cent of allergic and nonallergic groups, respectively, and that after 10 years of age the onset occurs in not more than 2 per cent in either group.

Beyond 10 years of age in the extrinsic group, the ratio of males to females was 1.2:1; in the intrinsic group, this ratio was 1.3:1. From birth to old age, the ratio of males to females in the extrinsic group was as 1.3:1. In the intrinsic group, it was 1.1:1.

In the unclassified group there were no cases in the first two decades of life and only three in the third. The largest number was in the fifth decade, in which males predominated. For all ages, the number of males and females was approximately even.

12. Peshkin, M. Murray: Asthma in Children, Am. J. Dis. Child. **36**:89 (July) 1928.

The study of this series of cases of extrinsic asthma affords many interesting observations as to both diagnosis and treatment. Of this group in 156 cases, a positive skin reaction was secured by the scratch method as previously described.

Table 2 shows the positive reactions secured in our series and tends to confirm the work of others who probably use more elaborate technic, rather than to offer anything unusual.

TABLE 2.—*Positive Skin Reactions in One Hundred and Fifty-Six Cases of Asthma*

Vegetables	37
Eggs	10
Milk	10
Fish	1
Wheat	7
Pork	4
Fruit	5
Coffee	1
Tea	1
Nuts	2
Feathers	106
Epidermals	27
Pollens	50
Hair	58
Wool	17
Cotton	5
Silk	12
Flaxseed	1
Orris root	10
Oats	1
Kapok	1
For 1 protein only	11
For 2 proteins	20
For 3 proteins	10
For 4 proteins	12
For 5 proteins	7
For more than 5 proteins	52

INTRINSIC ASTHMA

Every patient in this group was proved to have some infection of the upper respiratory tract. A definite sinus infection was present in every case, the largest majority being of the chronic catarrhal form. Our diagnoses, as previously indicated, are based on a thorough, carefully taken history, proper transillumination, intranasal examination, irrigation of the maxillary sinuses, shrinking and suction of the ethmoids and roentgenograms as an aid in drawing certain conclusions. The use of iodized poppy seed oil 40 per cent was seldom resorted to, and then only to tell what was not present rather than what might be present. As stated in table 1, there were 48 males and 42 females in this group. The onset occurred during the first two decades in only 14 cases, between 20 and 30 years of age in 11 cases, between 30 and 40 years in 24, between 40 and 50 years in 23, between 50 and 60 years in 15, and

TABLE 3.—*A Comparative Analysis of Extrinsic and Intrinsic Causes*

Author	Number of Cases	Extrinsic Causes											Intrinsic Causes	
		Absorption by Inhalation							Absorption by Ingestion					
		Pollens		Animal Dander		Vegetable Powder		By Inhalation	Food		Drugs		Cases Diagnosed, per Cent	Bacterial Asthma Undiagnosed Cases
		Number	Per Cent	Number	Per Cent	Number	Per Cent		Number	Per Cent	Number	Per Cent		Number / Per Cent
Rackemann, quoted by Cooke	500	150	25.0	55	9.0	9	1.5	27.8	12	3.2	0	0	31.0	408 / 69.0
Walker, quoted by Cooke	400	92	23.0	78	19.5	0	0	23.0	68	17.0	0	0	40.0	241 / 60.0
Cooke; J. Immunol. 7 : 159, 1922	327	86	26.0	138	42.0	52	16.0	69.8	12	3.6	4	1.2	73.4	87 / 26.0
Cleveland Clinic	314	50	16.0	27	8.5	0	0	24.4	37	12.1	0	0	49.6	105 / 33.4

between 60 and 80 years in 3 cases. Table 4 will serve to show the distribution of the sinus disease in this group.

In this group, 21 patients were operated on because they did not respond to the general and local measures applied to relieve the nasal infection. The diseased membrane in each case was examined by our pathologist, the usual findings being reported as follows: membrane edematous, some round cell infiltration, many eosinophils throughout the surface epithelium and thickened goblet cells in a few cases. In a few cases distinct polypoid formations were presented, completely filling the antrum or other sinus involved. Hansel [13] made similar reports of the cases in his series in which an elaborate study of the histopathology was made. Mullin and Ball [14] made pathologic studies of 100 cases of sinus disease of relatively long standing, and Mullin withheld any opinion regarding the correlation of the symptoms complained of, even

TABLE 4.—*Ninety-Seven Cases of Sinus Disease Associated with Bronchial Asthma*

	Ethmoid Only		Antrums		Pansinusitis		Ethmoid and Antrum		Frontal	
Age	Unilateral	Bilateral	Unilateral	Bilateral	Unilateral	Bilateral	Unilateral	Bilateral	Unilateral	Bilateral
10	..	..	2	..	..	..	..	..	..	..
20	..	..	4	..	2	..	1	..	..	..
30	1	..	2	3	1	..	4	..	..	..
40	3	3	4	2	..	2	5	..	1	..
50	2	5	10	3	1	5	7	1	2	..
60	..	1	2	4	..	2	3	2	1	..
70	1	..	3	..	1	1	..	..	..	..

though the microscopic examination showed the true pathologic condition which was present. Some of the patients in this group had bronchial asthma, their tissues showing the same changes as those of bronchitis and polyposis although only nasal symptoms were present. In the presence of this condition it is quite difficult to draw any conclusions from the sections. Ball, in his pathologic study, found principally edema, fibrosis, leukocytic reaction and glandular hyperplasia or atrophy. Many mononuclear leukocytes were noted, the largest number of cells being lymphocytes and plasma cells. In the asthmatic cases, large numbers of eosinophils were found.

The amount of bacteria actively present in all these cases is doubted by some writers. Armstrong [15] is of the opinion that bacteria enter the sinuses during respiration but are removed by the cilia. When edema is present, the motility of the cilia stops and bacteria become retained.

13. Hansel, F. K.: Noses and Sinuses in Allergy, J. Allergy **1**:43 (Nov.) 1929.

14. Mullin, W. V., and Ball, R. P.: Studies of Pathologic Tissue Removed from Chronically Infected Nasal Accessory Sinuses, Ann. Otol., Rhin. & Laryng. **37**:192, 1928.

15. Armstrong, M.: J. Iowa M. Soc. **10**:209, 1920.

After washing 45 normal antrums, 70 per cent were found to be sterile, while in the remaining 30 per cent about the same bacterial flora as in the nostril were found. In our group a culture was usually taken at operation, and in no case was it found to be sterile. The virulency of the bacteria in most cases was no doubt very low, but they were capable of becoming virulent under favorable conditions. Definite information can be obtained by getting a culture at the time of operation, and having vaccine made with which to test the patient for reaction to intradermal injection. More will be said of this under the discussion of treatment by vaccines.

What is the meaning of all this information we apparently have? Here are asthma, the diseased sinuses, and in many instances polyposis, with no evidence of the presence of any extrinsic agent either in the history or as the result of skin tests. Some underlying cause of their trouble must be present in these patients. The nasal mucous membrane is diseased, and being diseased is more sensitive or irritable to the toxin secreted by the bacteria that are present or to the proteins of the bacteria, or more likely to both factors. It is rendered more sensitive to temperature changes as the turbinates are unable to respond with the proper engorgement and contraction required by sudden changes. The tissue, being governed by the autonomic and sympathetic nervous systems which require a balance of sensations to function properly, is upset by improper responses which cause congestion and spasm of the entire respiratory mechanism, including bronchial spasm.

Viewed from the neurologic side, it is known that the sympathetic system is derived from the nasal ganglion by the vidian nerve, the great deep petrosals, the carotid plexus and the superior cervical ganglion; these nerves carry impulses to the lower cervical and upper or first thoracic ganglions. From this it is logical to conclude that a disturbed physiologic function of the nose is capable of causing bronchospasm in certain persons. It is the common experience of every one who deals with this problem that the removal of polypi will often stop asthmatic symptoms which return again when the polypi do. In this group it was noted in almost every case that the patient would be free or relatively free from symptoms in the summer, but in the fall and winter the asthma would return with its usual severity.

There is no question but that many cases of asthma overlap so that they belong to both the intrinsic and extrinsic types, a fact that makes it necessary to treat both types of factors.

UNCLASSIFIED GROUP

There were 52 cases in the unclassified group. In these we were unable to demonstrate any evidence of allergy from the history or the

skin test, and the nose and throat examination gave no evidence of disease of the upper respiratory tract.

In the majority of cases in this group the patients had one or more of the diseases listed in table 5. Some had as many as four. Of a total of 52 cases there are 27 cases in which some vascular disease was present, and, of course, in some cases in this group constitutional disturbances as well as foci of infection were present, as noted in table 5. Vascular disease is an important factor in the production of asthma, especially after the fourth decade of life. There were only 8 cases in which asthma was associated with chronic bronchitis or tuberculosis out of a total of 52 in which the patients suffered from these two common complaints.

TABLE 5.—*Unclassified Cases of Asthma*

			Vascular Disease				Pulmonary Disease		Focal Infection				Constitutional Disease				
Age	Males	Females	Myocarditis	Failure	Hypertension	Arteriosclerosis	Bronchitis	Tuberculosis	Teeth	Tonsils	Prostate Disease	Gallbladder Disease	Chronic Constipation	Diabetes	Endocrine Disturbance	Simple Goiter	Emphysema
10.....	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20.....	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30.....	2	1	0	2	0	0	0	0	0	0	0	0	0	0	0	1	0
40.....	2	7	0	0	0	0	3	1	3	2	0	0	0	0	0	0	0
50.....	10	8	5	1	2	1	3	0	1	0	1	1	0	1	0	2	0
60.....	8	5	5	1	2	1	1	0	1	0	0	1	0	1	0	0	0
70.....	5	4	6	0	0	1	0	0	0	0	0	0	0	0	0	0	2
Total.....	27	25	16	4	4	3	7	1	5	2	1	2	0	2	0	3	2

From the findings in this group, we hesitate to call the patients asthmatic in the true sense of the word. Most all of them were persons suffering from a combination of diseases which simulate bronchial asthma. The neurotic element has not been mentioned and is probably too infrequently encountered for cases presenting this feature to be included as a separate group. Walker,[10] in his report of 400 cases, considers these unclassified patients as having asthmatic bronchitis. Rackemann [16] found 150 such cases in his study of 1,074 and grouped them under three headings, chronic severe asthma, fatal asthma and asthma with tuberculosis, which he thinks have no special relation to each other. There is no question but that this last is a separate class as to etiology and should be considered as such in the diagnosis, classification and management of the disease.

16. Rackemann, Francis: Studies in Asthma: A Clinical Survey of 1,074 Patients with Asthma Followed for Two Years, J. Lab. & Clin. Med. **12**:1185, 1927.

LABORATORY OBSERVATIONS

It is interesting to note the lack of much information from the laboratory observations (table 6), although in each case reported there were a complete blood count, urinalysis, routine blood sugar estimation and a complement-fixation test.

The urine, as will be noted, shows the most marked change in the albumin content, and this change is rather constant in all ages, except in the unclassified group in which albumin is most frequently found after 40 years of age. The majority of laboratory reports showed only a faint trace of albumin, but it was found with sufficient frequency for it to be commented on.

TABLE 6.—*Routine Laboratory Observations According to Age and Classifications of Asthma*

	Urine																
	Sugar			Albumin			Pus		Casts		Red Blood Cells	Blood Sugar			Blood Eosinophils		
Age	Intrinsic	Extrinsic	Unclassified	Intrinsic	Extrinsic	Unclassified	Intrinsic	Extrinsic	Intrinsic	Extrinsic	Unclassified	Intrinsic	Extrinsic	Unclassified	Intrinsic	Extrinsic	Unclassified
10	2	0	0	6	2	1	0	1	0	0	0	0	0	0	6	1	0
20	0	0	0	0	1	1	0	0	0	0	0	0	0	0	1	0	0
30	0	0	0	5	2	1	0	1	0	0	0	0	0	0	5	0	0
40	0	0	0	4	9	3	0	0	0	0	1	0	0	0	3	3	0
50	1	1	0	6	13	6	0	1	0	1	0	0	1	3	0	4	0
60	2	0	0	6	10	6	1	1	2	0	0	1	0	0	2	3	0
70	0	0	0	2	2	6	0	0	0	0	1	0	0	1	0	1	0
80	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Total	5	1	0	29	39	24	1	4	2	1	2	1	1	4	17	12	1

Eosinophilia was constant in both the allergic and the infectious group, amounting to from 2 to 10 per cent, with an average of about 4.6 per cent. Brown,[17] reporting the incidence of eosinophilia in 346 different patients with asthma, hay fever and allied conditions, found it present in an average of 6 per cent of cases in males and in about the same percentage of cases in females. It was present in 7 per cent of 193 asthmatic patients, the sensitive and nonsensitive types showing the same percentage. Brown concluded that sensitization in asthma, therefore, has no influence on blood eosinophilia. Our percentages are not as high as those of Brown, the reason probably being that our blood differential counts were done in the routine laboratory tests, and as Brown pointed out these cells are susceptible to rupture and are frequently seen in smears as a mass of reddish granules, among which may be found a pale-staining lobulated nucleus.

17. Brown, Grafton Tyler: Eosinophilia in Asthma, Hay Fever and Allied Conditions, J. Lab. & Clin. Med. **12**:1145, 1927.

Eosinophilia of the tissues may be present without the presence of any special increase in the differential blood count. Any chronic inflammation may present eosinophilia, and usually the cause is never determined. Policard seems to think that this condition belongs more to the connective tissue family than to the blood cell family because of structural differences. DeJong thinks there is a close relationship between the eosinophils and fibroblasts. Bezançon and Bernard [18] pointed out that it always disappears from the blood stream during an acute infection and reappears again when it stops. From the point of view of function, it seems to follow mononucleosis more closely. In asthma one will often see tissue filled with eosinophils (Harany), while none of the polymorphonuclear neutrophils often present in tuberculosis and leprosy in the subacute and chronic stage are found. Some observers have found eosinophilia in all the mucous membranes from the sinuses to the alveoli.

Coates and Ersner,[19] in analyzing a group of cases, found that in about 75 per cent nasal polypi were secondary to other pathologic processes in the maxillary sinuses and that a considerable percentage culminated in asthma. In the group of asthmatic patients associated with suppuration of the maxillary sinus, eosinophils were found in large proportions. Normally, in an ordinary blood count from the mucous membrane, one eosinophil is found in the average count.

In acute infections there is an increase in the polymorphonuclear leukocytes, and in chronic infections an increase in lymphocytes. It might be expected that with the increase of polymorphonuclears and lymphocytes the eosinophil count would disappear. It was found, however, that in the asthmatic patients under observation the eosinophils were present in the mucous membrane in addition to the purulent conditions in that membrane.

It would appear that one may logically assume that asthma and the presence of eosinophils in the mucous membrane are closely associated.

ASSOCIATED DISEASES

The relation of asthma to other diseases is of considerable interest and importance. There is not a great deal of information compiled on this phase of the disease. Most of the known statistics are taken from health surveys of industrial groups, which are misleading for a definite study.

From our 314 cases there were only 50 in which some other disease was not present together with the asthma (table 7). In but a

18. Bezançon, F., and Bernard, E.: Ann. de méd. **27**:204, 1930.

19. Coates, G. M., and Ersner, M. S.: Occurrence of Eosinophils in the Mucous Membrane of the Maxillary Sinus in Asthmatic Patients, Arch. Otolaryng. **11**:158 (Feb.) 1930.

TABLE 7.—*Two Hundred and Sixty-Two Cases of Extrinsic and Intrinsic Asthma With Diseases Other Than Those in the Sinuses* *

Age	Myocarditis		Failure		Hypertension		Arteriosclerosis		Bronchitis		Tuberculosis		Eczema		Hay Fever		Teeth		Tonsils		Prostate	Gallbladder		Constipation		Diabetes		Bronchiectasis		Emphysema		Goiter; Adenoma		Syphilis		Hyperthyroidism	
	Intrinsic	Extrinsic	Intrinsic	Extrinsic	Intrinsic	Extrinsic	Intrinsic	Extrinsic	Intrinsic	Extrinsic	Intrinsic	Extrinsic	Intrinsic	Extrinsic	Intrinsic	Extrinsic	Intrinsic	Extrinsic	Intrinsic	Extrinsic	Extrinsic	Intrinsic	Extrinsic	Intrinsic	Extrinsic	Intrinsic	Extrinsic	Intrinsic	Extrinsic	Intrinsic	Extrinsic	Intrinsic	Extrinsic	Intrinsic	Extrinsic	Intrinsic	Extrinsic
10	0	0	0	0	0	0	0	0	0	2	1	0	0	2	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	2	2	0	0	2	0	2	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	2
30	0	0	0	0	0	0	0	0	2	2	1	3	0	4	0	8	1	0	1	4	1	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0
40	1	1	0	0	0	1	0	0	7	2	3	1	0	0	0	4	4	0	1	5	0	0	1	0	0	0	0	0	0	0	2	2	1	1	0	0
50	2	1	0	0	2	0	0	0	6	5	3	2	0	1	0	3	5	1	9	3	1	2	0	2	0	2	1	1	3	1	2	1	3	1	1	0	0
60	1	2	0	0	0	3	0	1	4	0	2	1	0	0	0	12	5	0	4	4	0	1	0	1	0	0	2	0	0	0	0	0	0	1	1	0	0
70	2	0	1	0	2	0	0	1	1	0	3	1	0	1	0	0	1	0	1	0	1	1	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0
80	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	6	4	1	0	4	4	0	2	20	13	15	8	0	10	0	30	16	1	16	17	4	4	1	5	0	2	4	1	4	1	4	4	6	3	2	0	2

very small percentage was only one other disease present, two or more being present in the majority of cases; in a considerable number of cases there were as many as four associated diseases. The diagnosis in each case has been based on positive findings and not on the impression of the examining doctor. Of the entire group of 314 patients, 97 were found to have sinus disease, which has been discussed; however, it should be borne in mind that many of the patients with sinus disease had other complicating factors.

Tuberculosis.—In 8.6 per cent of this group, the diagnosis was based on roentgenographic and clinical findings. In Framingham,[20] active tuberculosis was found in only 16 of 6,582 persons observed (2.4 per thousand). In Winchester,[21] the rate of tuberculosis was 2.1 per thousand. The reports from the United States Public Health Service gave the incidence of tuberculosis among normal persons as 1.3 per thousand in January, 1928, and 1.49 per thousand in February, 1928. The figures given in table 7, therefore, indicate a high incidence in our patients. Rackemann found 13 cases of tuberculosis among 1,074 cases of asthma.

Chronic Bronchitis.—In cases of both extrinsic and intrinsic asthma, chronic bronchitis is a very common complaint; it is more common in winter with the higher incidence of infections of the upper respiratory tract. In our series, in 20.6 per cent of cases in which sinus disease was present there was an accompanying bronchitis which had often been present for a number of years before the onset of the asthmatic symptoms. By animal experiments and by clinical observations, Mullin [22] demonstrated a lymphatic drainage from the antrums down the deep cervical chain and by the ducts and veins to the right side of the heart, thence directly to any or all parts of the lung. Moore [23] classified these cases in two groups: (1) those showing active suppurative tracheobronchitis, and (2) those with chronic passive congestion. In the first group inflammatory mucosa and considerable secretion are present; in the second, the mucosa assumes a tawny appearance with little or no secretion or with inspiratory and expiratory collapse of the bronchi, also with little secretion.

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20. Armstrong, D. B.: Framingham Monograph: Medical Series I; The Sickness Census, Framingham, Mass., Community Health Station, 1918.

21. Lombard, H. L.: A Sickness Survey of Winchester, Massachusetts: I. General Morbidity, Am. J. Pub. Health **18**:1089, 1928.

22. Mullin, W. V.: The Lymph Drainage of the Accessory Nasal Sinuses, Tr. Am. Laryng., Rhin. & Otol. Soc., 1919.

23. Moore, W. H.: Cilliary Distribution or Distinction in Tracheobronchial Asthma, Am. J. M. Sc. **160**:799, 1925.

Harkavy,[24] after a careful postmortem examination in 2 cases of nonprotein-sensitive asthma in which neither skin tests nor clinical course had given any evidence of the existence of protein hypersensitiveness, found in 1 of the cases (*a*) marked emphysema and bronchitis, dilatation of the bronchi leading to herniation of the wall as a result of persistent cough; (*b*) extensive hypertrophy of the bronchial musculature; (*c*) eosinophilic infiltration of the bronchial wall surrounding the engorged capillaries and in between the muscles fibers, similar to the findings in true allergic asthma, and (*d*) hyalinization of the basement membrane.

Vascular Disease.—Different types of vascular diseases were found in 8.7 per cent of the cases, the incidence being about equal in the intrinsic and extrinsic groups. In all cases the patients were beyond the fourth decade of life, the majority being in the fifth and sixth decades. Just what part the vascular disturbances played in producing the bronchospasm is not known, as in every case there was evidence of other contributing causes for the asthmatic attacks. Harkavy [24] found that the postmortem condition of the vascular tree showed severe sclerosis of the pulmonary arteries, with subintimal infiltration of the wall of some of the larger arteries by eosinophilic cells in 1 case (that previously cited). In the case of nine years' duration, there were marked hypertrophy and dilatation of the right ventricle, while in the other case of six months' duration there was absence of right-sided cardiac involvement. The hypertrophy of the right ventricle in the first of these cases was due to marked emphysema. Alexander, Luten and Kountz,[25] in a review of 50 cases in which the disease was of ten years' or more duration, found that the heart was rarely enlarged and often comparatively small. They recorded the venous pressure, which would rise from 200 to 300 per cent during an attack. They found a tendency to low blood pressure, as we did in the majority of our cases; they also found an absence of right-sided preponderance from either roentgenographic or electrocardiographic findings. From these studies and observations it must be concluded that the weight of evidence shows that paroxysmal asthma does not play a very important rôle in vascular disease.

Hay Fever and Eczema.—In this group every patient was found to be sensitive to some protein substance. The hay fever incidence was 11.2 per cent, the accompanying asthma usually occurring as an aggravation of the hay fever symptoms, and where these symptoms had been

24. Harkavy, Joseph: Observations on Fatal Bronchial Asthma, J. Allergy **1**:136, 1930.

25. Alexander, H. L.; Luten, D., and Kountz, W. B.: Effect on Heart of Long Standing Bronchial Asthma, J. A. M. A. **88**:882 (March 19) 1927.

present for three or more seasons. Rackemann,[26] in a series of 648 cases of asthma, found it present in 99 cases, or 28.5 per cent of 347 cases of hay fever, which is a considerably higher incidence than in our series. He also found, as we did, that in some cases of pollen asthma the symptoms continued beyond the hay fever season. This phenomenon can be explained only by the fact that these persons are sensitive to something other than pollens or that their irritable mucous membrane has been unable to adjust itself and the reflex is easily stimulated by substances that would not ordinarily cause a bronchospasm. Rackemann [26] found that of 27 patients with eczema, only 5 had asthma, which seemed to come and go with the eczema. We found it present in 3.7 per cent of the cases in our series, and it must be recalled that very few of our cases were in children. Bray [27] found that of 200 children with asthma, 24.3 per cent had eczema and 6.2 per cent hay fever, care being taken to exclude eczema of short duration or hay fever of an occasional sneezing, nonseasonal and nonenvironmental nature.

Infected Teeth and Tonsils.—Infections of the teeth or tonsils do not show anything unusual in the presence of asthma. The only bearing either might have on the asthma would be to affect the general condition, except possibly in the case of children in whom a prolonged respiratory obstruction has been superimposed on a nervous or neurotic element. It will be noted, however, that among the cases of the infected teeth, which number 17 for the extrinsic and intrinsic types, 16 belong in the intrinsic group and only 1 in the extrinsic class. We have on record the case of a man who had suffered with severe asthma for a number of years. An infected lower bicuspid tooth was extracted; the asthma soon subsided, and the patient has had no further attacks. I mention this as being of considerable clinical interest.

In an equal number of cases of both the intrinsic and extrinsic type of asthma, infected tonsils were present but they seemed to play no particular rôle in the production of either type.

Diabetes Mellitus.—In our experience diabetes mellitus is rarely associated with asthma, only 2 patients having had asthma in 1,500 cases of diabetes. Joslin [28] encountered 6 cases of asthma in more than 6,000 diabetic patients. The only case in which this association occurred was observed by Rackemann, and had been referred to him by Joslin. Walker saw only 2 cases of diabetes among from 2,500 to 3,000

26. Rackemann, Francis: A Clinical Classification of Asthma Based upon a Review of Six Hundred and Forty-Eight Cases, Am. J. M. Sc. **162**:802, 1921.

27. Bray, George: The Hereditary Factor in Asthma and Other Allergies, Brit. M. J. **1**:384, 1930.

28. Joslin, E. P.: Treatment of Diabetes Mellitus, Philadelphia, Lea & Febiger, 1928, p. 733.

asthmatic persons. Beckman [6] attempted to explain the absence of asthma among diabetic persons as being due to biochemical blood changes. To my mind, a considerable amount of scientific blood study will be required to substantiate this theory.

Hyperthyroidism.—This constitutional disease affects many different organs of the body, but rarely is a person with hyperthyroidism afflicted with asthma. Over a period of ten years, during which an average of about 1,000 cases were seen each year, asthma was observed in only 2 cases. We have noticed several patients with asthma who presented certain symptoms of hyperthyroidism. When the case was analyzed, however, the symptoms were found to have been caused by an overuse of epinephrine. Rackemann [29] did not observe hyperthyroidism among 1,074 cases of asthma and made the statement, "he watched for evidences of it, but with no success."

GENERAL HEALTH

There were 50 patients who were free from any other disease. Needless to say, in all of these the condition was extrinsic.

It is the belief of some that allergic patients or patients with asthma are very resistant to other diseases and infectious processes. Balyeat,[30] reporting 372 cases of asthma in adults, found that 260, or 69.8 per cent, fell in the "above normal class," 73, or 19.3 per cent, in the normal, and 39, or 10.4 per cent, in the "below normal class." Among 174 children suffering from asthma, 126, or 72.4 per cent, fell in the above normal class, 40, or 22.9 per cent, fell in the average normal class, and 9, or 4.6 per cent, in the below normal class. Rackemann [16] thinks that allergic persons are more susceptible to tuberculosis, to colds and to acute infectious diseases than are normal persons but not any more susceptible to cancer. Such a question is difficult because a correct answer can be based only on the observation of several thousand cases. It is our belief that patients with asthma are people who are greatly below par and often require painstaking care and advice to bring them within a normal level of general health. Balyeat [30] lays considerable emphasis on the fact that allergic persons are healthy and offers the hypothesis that those who inherit the ability to become specifically sensitive have a body made up of hyperirritable cells. He admits that the formation of antibodies is atopic in two separate and distinct processes; then he reasons that it would be logical to believe that a person whose cells develop atopic bodies with ease should also develop antibodies against pathogenic organisms with similar ease.

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29. Rackemann, Francis; and Colmes, A.: The Clinical Characteristics of Hypersensitiveness, J. Allergy **1:2**, 1929.

30. Balyeat, R. M.: The Hereditary Factor in Allergic Diseases, Am. J. M. Sc. **176**:332, 1928.

Prausnitz and Küstner [31] injected the serum of allergic subjects into the skin of normal persons, and the infiltrated skins have thereby acquired a temporary hypersensitiveness to the exciting agents, showing the presence of free antibodies in the injected serums, and yet, as Kolmer [32] pointed out, the same antibodies in the blood of allergic persons do not protect them against reactions, due probably to an important quantitative factor not understood at the present time. The allergic symptoms do not occur until the antibody is produced and, if the cellular theory is correct, not until sufficient antibodies have sensitized enough cells to result in allergic reactions of sufficient degree to produce lesions or symptoms. In other words, instead of protecting against the disease like typhoid vaccine, the opposite is true—the antibodies produce the disease when in contact with the antigen. With these facts in mind I am unable to reason why any allergic persons should show special resistance to pathogenic organisms because of the ability to make antibodies, as the two processes are quite separate. Factors other than immunity must govern the general health of these people and their resistance to disease. This phase will be discussed under the treatment for asthma.

HEREDITY

One of the underlying bases for each individual case of asthma is that it tends to be inherited, especially asthma due to foreign proteins. Rackemann [26] refers to this as the "asthmatic" state which underlies not only the various forms of asthma but such other conditions as hay fever, food and drug idiosyncrasies and certain cases of urticaria, angioneurotic edema, eczema, etc.

Cooke and his associates showed that the percentage of atopic children was greatest (69.5) in families subject to a bilateral hereditary influence, and least (41.1) in those in which there was no familial history of an atopic condition. They were able to show that the age of onset of the atopic symptoms is distinctly affected by inheritance. This is seen in the fact that under bilateral influence, 72 per cent of the affected offspring begin to exhibit symptoms before the tenth year of age, whereas only 35 per cent of the unaffected children that are subject to a unilateral familial influence have begun to show symptoms by that age; this percentage falls to 20 among those children whose atopic family history is negative. Coca [33] reasons from this that the date at which an atopic person will begin to experience atopic symptoms is usually predetermined in the inheritance.

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31. Prausnitz, C., and Küstner, H.: Centralbl. f. Bakt. **86**:160, 1921.

32. Kolmer, John A.: The General Principles of Allergy, Arch. Otolaryng. **12**:804 (Dec.) 1930.

33. Coca, Arthur: Studies in Hypersensitiveness on the Influence of Heredity in Atopy, J. Lab. & Clin. Med. **12**:1135, 1927.

With a fairly close follow-up on this series we were able to get a positive family history of hay fever, asthma or eczema in 48.4 per cent of cases. Thirty-seven and five-tenths per cent of these were sensitive to foreign proteins as proved in our examinations.

TREATMENT

Bronchial asthma, like most constitutional diseases, must be treated locally, generally if necessary and individually always. We have attempted to follow out this scheme in most of our cases, but often we only see the patient for diagnostic purposes and we never have the opportunity of following them up with supervised treatment.

TABLE 8.—*Therapeutic Measures as Applied to 291 Cases Without Any Special Supervision*

	Number	Improved	Cured	No Benefit	Condition Worse
Nasal operations	44	31	8	5	0
Medicines	103	84	11	9	0
Dietary measures	31	25	6	0	0
Climate change	14	6	4	3	1
Environmental change	12	7	2	2	1
Use of quack remedies	28	15	2	8	3
Chiropractic and osteopathic treatment	12	2	0	9	1
Vaccine (stock and autogenous)	18	12	2	3	1
Desensitization	9	3	3	2	1
General care only	12	6	0	6	0
Total	291	201	34	48	8

For a check-up and study of this series we have sent out letters of inquiry to the people we have seen in the clinic. The patients have been very responsive, and their letters have contained much valuable information (table 8).

Nasal Operations.—There were 44 operations of all kinds on the nasal passages. All cases were classified as intrinsic asthma. The Caldwell-Luc operation was done in 18 of these cases with improvement in 15 and marked improvement in 3, the symptoms returning only when an acute cold started. Submucous resection was done in 5 cases, with improvement in 3. The ethmoids were cleaned out in 6 cases together with the Caldwell-Luc operation with improvement in 4 cases. Following almost all the operations, the asthmatic symptoms subsided entirely for from two to four months and in a good percentage of cases did not return with the same severity as before. General improvement has been noted in the entire group in which the infected sinuses were drained properly.

This is a small group from which to draw any conclusions. Rackemann reported a series of cases in about one half of which operations were performed; in the others medical treatment was given and the comparative results were recorded (table 9).

Rackemann and Tobey [34] concluded from this series that the presence of foci in the nose and throat bears little relation to the outcome of the asthma. The gross results of treatment of foci are disappointing, as shown by the comparison of patients with foci in the groups in which operations were and were not performed, and by an analysis of the different lesions treated. Treatment of the nose and throat and teeth has apparently brought about permanent relief from asthma in 5 per cent of the cases. It is suggested that local lesions of the nose and throat may develop from the same fundamental cause as the asthma itself and be part of the pathologic process of the disease. Grant reported great

TABLE 9.—*End-Results, With and Without Operations*

Focus of Infection	Cases		Per Cent of Patients	End-Results			
				Per Cent Cured	Per Cent Improved	Per Cent Same	Per Cent Dead
Sinuses	271	With operation	34	14	46	31	9
		Without operation	66	17	52	26	5
Tonsils and adenoids	178	With operation	45	21	54	24	1
		Without operation	55	21	46	23	10
Teeth	197	With operation	58	7	49	29	15
		Without operation	42	17	42	29	12

improvement in 39 per cent of his cases, some improvement in 42 per cent and no improvement in 19 per cent. Piness, in 1925, reported 834 cases, in 49 per cent of which operations were performed without beneficial results.

Medical Treatment.—When a patient was found to be sensitive, the need for general treatment was explained in detail. The general health of the subject was considered, and he was usually put on a regimen of proper rest and dietary measures, with cod liver oil and calcium lactate in moderate doses.

From among the rather numerous drugs employed for symptomatic treatment, epinephrine chloride gave the most satisfactory results in the treatment of the immediate attack, and ephedrine sulphate in moderate doses was more effective in the prevention of frequent asthmatic crises when given over a period of time. In a considerable number of cases in which the tolerance to epinephrine had caused it to lose its full effect, the potassium and sodium salts of iodine seemed to furnish the necessary

34. Rackemann, Francis; and Tobey, Harold: Studies in Asthma: The Nose and Throat in Asthma, Arch. Otolaryng. **9**:612 (June) 1929.

stimulation of bronchial secretions and gave excellent results in relieving the severity of the symptoms.

Different combinations of antispasmodic drugs were used with temporary relief in a large percentage of cases as they seemed to shorten the attack somewhat. Macht [35] found benzyl benzoate of value in relieving the spasm in infants. It may be given in capsules or dropped on sugar. Large doses should be given; 5 minims (0.3 cc.) of the benzyl benzoate can be given to a 10 year old child or 20 minims (1.25 cc.) of the alcoholic solution.

Vaccines.—We have the final results of the administration of vaccines in only 18 cases, in 15 of which autogenous vaccines were used. The vaccines were usually obtained from the sputum coughed from the bronchi, or in many instances directly from the trachea. The culture is made directly in an ordinary sized test tube containing Rosenow's brain broth; after twenty-four hours the culture is inspected, and if the growth is not good it is allowed to incubate another twenty-four hours. The growth being obtained, the liquid is poured off and one drop of tricresol for each 2 cc. of suspension is added; it is mixed well to make a good emulsion and allowed to stand for two days before being used.

An intradermal injection is made to determine whether or not the patient is sensitive to the strain; if so, we start with small doses given about every day and gradually build up the patient to a certain point of tolerance, the reaction being carefully noted. If satisfactory results are not secured with one preparation, then others are made until a suitable one is found. This form of therapy is most frequently used in the treatment for asthma of the intrinsic or infectious type. We often take cultures from the trachea and in a number of cases have secured excellent results.

In cases in which sinus disease is associated with asthma and an operation is performed, a tube of Rosenow's brain broth is inoculated directly at the site of operation. This is done by dissecting a good sized block of tissue from the antral wall and dropping it in the broth. We believe the offending organism is most often embedded in the membrane of the sinus rather than found in the sinus washings. Our results have been most satisfactory in the small series of cases in which we have used this method. This process eliminates the possibility of losing the important organisms by having the swab become sterile when the material becomes dried out, which often happens before the transplant can be made. If the sputum is collected and allowed to stand for any length of time, many things can happen to it such as changes in temperature, contamination and improper handling by technicians who

35. Macht: Therapeutic Study of Benzyl Benzoate in Bronchial Asthma, South. M. J. **12**:367, 1919.

are not particularly interested in the problem of getting a certain strain. It is our contention that all inoculations, whether from an operative site or from secretions elsewhere, should be taken directly as described.

Most workers credit the results obtained to an unknown nonspecific protein reaction. Rackemann and Scully,[36] reporting results in 346 cases of asthma in which vaccines were used, obtained good but only temporary results in 74 per cent; however, the good results could be repeated time and again, which makes it an important agent for the patient. These investigators found that stock vaccines gave just as good results as autogenous vaccines and were unable to conclude that one organism was more important than another. The fact that one vaccine works better than another shows that there must be some form of specificity that is unexplainable. Whatever the mechanism, it is the same in the asthmatic as in the nonasthmatic person. Duke,[37] by the use of colon bacilli subcutaneously or intravenously in very small doses, obtained good results in some cases of allergy in which specific measures had failed for some reason. Walker [38] reported 54 cases in which asthma was associated with colds as having been treated periodically with a vaccine consisting of the most prevalent types of streptococci for each respective period. Fifty-nine per cent of the patients obtained either freedom or comparative freedom from asthmatic colds for periods of a year or more following each course of vaccine. Thirty-six per cent of the patients obtained satisfactory results for periods of more or less than a year.

We have never resorted to the use of vaccines until a careful study of the patient has been made, so as to rule out the possibility that any possible foreign protein is a factor and until foci of infection and other lesions have been removed or treated. It is our belief that the best indication for the use of vaccines is the presence of an asthmatic bronchitis and a cold, especially in children, and in those adults in whom attacks occur at long intervals and are preceded by colds. Many patients in our group of cases of intrinsic asthma who were past 40 years of age and who had their attacks only in the winter and fall and were free in the summer months could no doubt be benefited by the proper use of vaccines.

Climatic changes were quite beneficial to a large percentage of the patients in the extrinsic group, the large majority being hypersensitive persons; there were only 3 in the intrinsic group and just 1 person benefited by the change. As we have stated, it is a well established

36. Rackemann, Francis; and Scully, M. S.: The Use of Vaccines in Asthma and Colds, New England J. Med. **199**:314, 1928.

37. Duke, W. W.: Details in the Treatment of Hay Fever, Asthma and Other Manifestations of Allergy, Am. J. M. Sc. **166**:645, 1923.

38. Walker, I. Chandler: Colds, and Asthma Associated with Colds, Arch. Int. Med. **43**:429 (April) 1929.

observation that going to a mountainous country with high altitude or on a sea voyage will relieve most asthmatic persons. If the patient is not sensitive to some pollen, the reason for the benefit is quite difficult to understand. Beckman [6] thinks the same, but, as I have stated before, in a high altitude there is a lowering of the alkali reserve and this tends to relieve asthmatic symptoms.

Environmental changes afford many interesting instances of relief as well as production of asthma. A great many spectacular cures have resulted after the patients have changed their dwelling place, and in many cases the symptoms return when they go back to their former homes. All of our cases in which an environmental change altered the condition were in the extrinsic group.

It is my belief that individual cases in which there has been an unusual cure should not be reported unless there is some underlying medical principle that might prove to offer a helpful suggestion in carrying out further investigation. For this reason I mention 2 cases of intrinsic asthma in women between 25 and 30 years of age in which the usual measures employed failed to give much relief. The infected sinuses were washed frequently without very much resultant relief. On suggestion, we instilled iodized oil diluted one-half with sterile olive oil into both antrums with relief in both cases for from three to four days at a time. To prove there was no psychic factor present, we used straight olive oil on two occasions with no relief in either case. We questioned the family relative to the onset of attacks and found that they had often noticed that the asthma began while the patient was asleep. In the presence of disturbed nasal physiology there must be some chemical reaction that takes place which affects the nerve endings in the sinus mucosa inhibiting the reflex action.

Two other cases were in men between the ages of 40 and 45, both with severe intrinsic asthma. Pathologic conditions in the nose were removed with temporary relief in both cases, but when the symptoms did reappear they were much more severe. The tolerance to epinephrine was high, the effects were short, and there was no complete relief at any time. In both cases it was necessary to resort to the oxygen tent to secure relief, and the patients lived under tents continually for several weeks in order to get enough oxygen to live. Dr. G. W. Crile was called in consultation, as his recent clinical research had been with surgery on the suprarenal glands. He advised a denervation of both suprarenals, which was done. One patient was operated on on Sept. 12, 1930, and has been completely relieved up to the present time—a period of nine months. The second patient was operated on in two seances, one on Dec. 15, 1930, and the second on Jan. 7, 1931. Following the second denervation, the symptoms subsided to light infrequent attacks. The patient was discharged from the hospital about Feb. 1, 1931, in good

condition. His general health was poor, however, and he did not respond well to the measures instituted to build him up. Soon after returning home, he contracted a severe cold which caused him to have a return of his symptoms, but the attacks were much shorter and less severe than before. On March 22, 1931, he visited the clinic for observation, and his condition was found to be fairly good. Enroute home, he developed an attack of asthma and died. The cause of death at the time is difficult to explain as the asthma had been occurring in very mild attacks since his operation.

Whether the denervation tends to stabilize the gland, which has become fatigued by being overstimulated during a long period of time, or whether the smooth muscles become spastic due to an excess epinephrine drive from an overstimulation of the sympathetics, this drive being diminished by the operation, has not been definitely established, nor do we make any claims for absolute results from this operation; but it may prove to be of some value in selected cases until more work has been done in this direction.

James Adam of Glasgow, Scotland,[39] thinks that the suprarenals become exhausted by prolonged toxicosis, that the adrenal medulla promotes bronchospasm and the cortex promotes cachexia, a condition that is rather characteristic of most chronic asthmatic persons. Cramer suggests that products derived from intestinal putrefaction, e. g., histamine, cause stimulation of the suprarenals; Dale, who thinks that a close similarity exists between the condition of the blood of adrenalectomized animals and animals that have been receiving large doses of histamine, concludes that "the evidence strongly suggests that the function of the adrenals is to antagonize the action of histamine and probably of similarly constituted substances." In other words, the prolonged intestinal putrefaction tends to overstimulate and exhaust the suprarenals.

General care and proper understanding of how to regulate the mode of living are an important phase of the treatment in any given case. Just as in the case of any other sick person, each asthmatic patient is almost a law to himself.

It has been interesting to read the answers to our letters of inquiry. A large majority of people who have had no relief from any of the standard treatments have abandoned the idea of being cured medically and have taken it on themselves to learn what not to eat, how much to eat and the combinations that cause them trouble. While they may have an occasional attack, they are able to live a very happy existence.

The final word regarding treatment may be summed up by saying that any one or all of the scientific measures we have described should be employed according to the conditions presented in the individual case.

39. Adam, James: Asthma, a Toxemia, M. J. & Rec. **130**:583 (Nov. 20) 1929.

BACTERIOSTATIC PROPERTIES OF THE SECRETIONS OF THE SINUSES *

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The normal secretions of the sinuses is a grayish, viscous fluid that bathes the entire lining membrane, protecting it and assisting the ciliated epithelium in the removal of foreign substances. The physical properties of this fluid and its rôle in the protection of the sinuses have been studied by Yates,[1] Walthard [2] and Stark.[3]

Bacteriologic observations by Törne,[4] Frankel,[5] Calamida and Bartarelli,[6] and Linton [7] indicate that the normal nasal sinus is usually sterile. The important rôle played by the ciliated epithelium in producing this result is recognized; however, it has long been suspected that some antibacterial substance in the secretions is a contributing factor. It was the object of this study to determine whether such a substance exists, and, if it does, to find out something of its nature.

According to Hilding,[8] the normal histology of the sinus in man shows numerous goblet cells in the epithelium and the glands of the tubular and compound racemose types in the submucosa; the latter may be mucous, serous or mixed. It is evident, therefore, that the secretion may vary in consistency, depending on the relative activity of the mucous and serous glands. Under normal conditions, however, the amount of variation is slight. The principal constituent and the one that imparts its characteristic viscous properties to the secretion is the mucus as

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1. Yates, Lowden: Methods of Estimating the Activity of the Ciliated Epithelium Within the Sinuses, J. Laryng. & Otol. **39**:554, 1924.

2. Walthard, M.: Ueber antibakterielle Schutzwirkung des Mucins, Centralbl. f. Bakt. **17**:311, 1895.

3. Stark, W. B.: Irrigations with Aqueous Solutions: Their Effect on the Membranes of the Upper Respiratory Tract of the Rabbit, Arch. Otolaryng. **8**:47 (July) 1928.

4. Törne, Frans: Die bakteriellen Verhältnisse der Nebenhöhlen und über ihre Schutzmittel gegen Bakterien, Nord. med. Ark., 1904, pt. 1, no. 2.

5. Frankel, E.: Beiträge zur Pathologie und Aetiologie der Nasennebenhöhlenkrankungen, Virchows Arch. f. path. Anat. **134**:42, 1896.

6. Calamida and Bartarelli: Ueber die Bakterienflora der Nasensinii und des Mittelohrs, Centralbl. f. Bakt. **32**: 428, 1902.

7. Linton, C. S.: A Comparative Study of the Bacterial Flora of the Clinically Normal Nasal Sinuses, Ann. Otol., Rhin. & Laryng. **39**:779, 1930.

8. Hilding, A.: The Common Cold, Arch. Otolaryng. **12**:133 (Aug.) 1930.

secreted by the goblet cells and the mucous cells of the glands in the submucosa. The term mucus, as commonly used, is applied to the secretion from a mucous membrane, although the nature of the accompanying secretions, cellular elements and impurities may vary considerably. It consists of water, mucin, inorganic salts, epithelial cells, leukocytes and granular matter. Mucin is a chemical entity classified as a glycoprotein. It probably differs from the mucoids or chondroproteins in the nature of the protein part of the molecule. It occurs chiefly as a potassium salt, while cartilage mucoid occurs chiefly as a calcium salt.

The higher incidence of sinusitis in swimmers in whom the secretion is washed away and in deficiency disease, as pointed out by Dean,[9] in which atrophy of the secreting gland occurs (Mori [10]), indicates a relationship of the secretion to the prevention of infection. The physical properties of the fluid and constant replenishment from the membrane surface with an outward flow through the ostium would account for some beneficial effect.

The natural immunity of the mucous membrane to infection was noted in the early days of bacteriology. Park and Wright, quoted by Wagner,[11] stated that "For bacteria which have developed in the blood or secretions of other individuals, the bactericidal power of the nasal mucus is little or nothing and cannot be depended upon to prevent infection." Haugenschmidt,[12] working with saliva, filtered, unfiltered and heated, found that the saliva has little or no germicidal power, and believed that freedom from infection of wounds in this part of the body is due to active phagocytosis induced by the power of the saliva to stimulate migration of leukocytes. He also observed that the continuous degeneration of the superficial layers of epithelium was an important mechanical factor in the prevention of bacterial invasion. Wagner [11] was able to cultivate bacteria on mediums containing mucin obtained from the submaxillary glands of animals. He also believes that natural resistance of the mucous membranes depends largely on the "activity of leukocytes" which do not totally destroy bacteria but greatly diminish their ability to form poisonous products.

Törne,[4] working with secretions principally from the maxillary sinus of the calf and the human being, found that the sterile, undiluted

9. Dean, L. W.: Relation of Deficiency Diet to Diseases of the Sinuses, Ann. Otol., Rhin. & Laryng. **38**:607, 1929.

10. Mori, S.: The Changes in the Para-Ocular Glands Which Follow the Administration of Diets Low in Fat-Soluble A with Notes of the Effect of the Same Diets on the Salivary Glands and the Mucosa of the Larynx and Trachea, Bull. Johns Hopkins Hosp. **33**:357, 1922.

11. Wagner, H. L.: Natural Immunity of the Mucous Membrane of the Respiratory Tract, Tr. Am. Laryng. A. **19**:61, 1898.

12. Haugenschmidt: Divers procédés de défense de la cavité buccale contre l'invasion des bactéries pathogènes, Ann. Inst. Pasteur **10**: 545, 1896.

secretions caused a slight drop in the numbers of inoculated anthrax bacilli, which reached a maximum in about thirty minutes. The numbers then began to increase progressively. He also observed a decrease in the bactericidal properties of the secretions when heated to 55 C. for forty minutes and a destruction of these properties when heated to 65 C. for forty minutes. However, the drop in numbers of bacilli observed by Törne was not large, and might readily be accounted for by the transference of an actively growing culture to an unfavorable environment.

Schousbar [13] secured nasal secretions by injecting pilocarpine into man, or by pressing them from a cotton wad that had been placed in the nasal cavity. The secretions were sterilized by heating to 55 C. on three successive days. Bactericidal action, which was destroyed at 70 C., was found for anthrax, Staphylococcus albus and Erythrobacillus prodigiosus. Walthard [2] secured mucus from the cervical canal and placed it in the water of condensation of agar slants. The material was spread over the surface of the slants, which were then inoculated. Abundant growth resulted. To test the effect of the mucus alone on the bacteria, he spread some of it in a sterile glass plate and inoculated it heavily at one point. After fourteen days, at 37 C., there was no evidence of spread of growth, but the organism was still alive, as shown by its growth on transferring it back to a favorable medium.

Arnold, Ostrom and Singer [14] sprayed cultures of prodigiosus and coli of constant density and quantity into each nostril of human subjects. Swabs taken from the membrane in a uniform manner and streaked on agar plates showed that the membrane was usually sterile after one hour. These authors were unable to develop a resistant strain by repeated application to the mucous membrane and there was no explanation of the "disinfecting mechanism." Growth-inhibiting substances could not be demonstrated by the dilution of nasal secretions and washings in broth. At a temperature of 95 F. and a humidity of 90 per cent, there was a retardation in the rate of disappearance of bacteria from the nasal mucosa.

Goldsworthy and Florey [15] used various tissue extracts and secretions from the cat, dog, rabbit, guinea-pig, human being and goat, with the object of determining whether lysozyme enters into the protective

13. Schousbar, M. J.: Bakterien in der normalen Nasenhöhle und die bakterientotende Wirkung des Nasensekretes, Dissert., Odense, Hempel; abstr., Nord. med. Ark. **1**:11, 1901.

14. Arnold, Lloyd; Ostrom, M. L., and Singer, C.: Auto-Sterilizing Power of the Nasal Mucosa, Proc. Soc. Exper. Biol. & Med. **25**:624, 1928.

15. Goldsworthy, Neil E., and Florey, Howard: Some Properties of Mucus, with Special Reference to Its Antibacterial Functions, Brit. J. Exper. Path. **11**:192, 1930.

mechanism of the intestinal mucosa. Colon mucus was secured by injecting a weak solution of volatile oil of mustard, U.S.P., in olive oil into an isolated section of the colon and leaving it for two hours. Washings were secured by injecting physiologic solution of sodium chloride and massaging. Mucus from the colon of the cat showed no inhibition and no lysis with several strains of bacteria that were susceptible to lysozyme action. However, in view of the work of Wolff,[16] who showed that lysozyme is firmly bound by lipoids, this method of examining for its presence could hardly be considered as adequate. Extract from the colon mucosa of the cat showed inhibition to lysozyme-susceptible organisms in some experiments and not in others. Mucosa from the small intestine was uniformly inhibitory. The authors believe that the protective properties of mucus reside more in its mechanical properties. Fast-moving vibrios were observed to be checked in the mucus near the cells. The layer is increased in thickness by irritation.

Studies have been made on the antibacterial properties of saliva, milk, skin and other tissues. From work on human saliva filtered through a Cumberland bougie, Sanarelli[17] concluded that it is an unfavorable medium for Staphylococcus aureus, Micrococcus tetragenes, typhoid bacillus and cholera vibrio, and that some species, such as the pneumococcus, are able to continue development but are much changed in form and attenuated in virulence. However, Miller[18] pointed out that filtered saliva has only about 0.15 per cent of organic matter, while saliva in the mouth has a large amount of nutritive material in the form of epithelial débris, exudates, etc. Haugenschmidt[12] found heated saliva more bactericidal for staphylococci than unheated saliva. Hanssen,[19] working with cow's milk, found it to be bactericidal to the typhoid bacillus and paratyphoid B in the first one to four hours at 37 C. However, he found that this property varied in the same cow at different seasons. It was completely destroyed at a temperature of 75 C. for fifteen minutes, but resisted temperatures of 63 C. for thirty minutes and 70 C. for fifteen minutes. Singer and Arnold compared the autodisinfecting power of skin cleaned with soap and water, with dirty or fatty skin. They found from 90 to 95 per cent of the bacteria on the clean skin rendered nonviable in ten minutes, while those exposed to dirty skin remained viable for several hours after application.

16. Wolff, L. K.: Untersuchungen über das Lysozyme, Ztschr. f. Immunitätforsch. u. exper. Therap. **50**:88, 1927; **54**:188, 1927.

17. Sanarelli, G.: Der menschliche Speichel und die Pathogenen Mikroorganismen der Mundhöhle, Centralbl. f. Bakt. **10**:818, 1892.

18. Miller, W. D.: Die Mikroorganismen der Mundhöhle, ed. 2, Leipzig, Georg Thieme, 1892.

19. Hanssen, Finn S.: The Bactericidal Property of Milk, Brit. J. Exper. Path. 5:271, 1924.

Viability was retained better in the finger-nail region. Brann [20] also made a study of the antibacterial properties of the epidermis to Staphylococcus aureus.

Fleming,[21] Gorghi,[22] Mazzetti,[23] Goldsworthy and Florey [15] and many others have worked on the antibacterial properties of tissues or tissue extracts. In most cases, a retarding or destructive influence was noted. Fleming examined a large number of tissues and secretions from the human body, and found lysozyme present in all of them except the spinal fluid, the urine and the sweat. It was present in large amounts in cartilage and in a high concentration in tears. Considerable quantities were found in nasal mucus and saliva. The tissues of man contained much more than those of the rabbit and guinea-pig, while the tissues of the dog ranged about midway between.

The wide distribution of factors for defense in the tissues and secretions of the body would lead one to suspect the existence of more than an ordinary one in the secretions from the mucous membranes. This is especially true of the mucous membranes lining the nasal sinuses, which are usually found to be sterile.

The properties of lysozyme have been well summarized by Ridley.[24] He stated that its characteristics are those of an enzyme; it is a yellow, amorphous powder (Wolff [16]), soluble in water and saline, is not destroyed by drying below 40 C., and remains potent for many months. It is destroyed quickly above 75 C.; it acts most rapidly at 60 C., but is quite efficient at 37 C. He found that traces of free acid or alkali inhibit its action, while an excess quickly destroys it. It is an electropositive or electroneutral colloid, strongly absorbed by many substances in suspension; it passes only saturated porcelain filters, and is not affected by peptic or tryptic digestion. When highly purified, none of the protein reactions are given, and it contains no nitrogen, phosphorus or sulphur. The partition coefficient in an oil-water mixture shows practically all of it in the oil, to which it is firmly bound. When lysozyme is injected intravenously, less than 4 per cent is excreted in the urine, owing to fixation by the lipoids of the body. It is not used up during lytic activity. The bacteria swell, lose their outlines and

20. Brann, G.: Untersuchungen über die Baktericide der Haut, der Haare, und des Ohrenschmalges, Klin. Wchnschr. **7**:2059, 1928.

21. Fleming, A.: A Bacteriolytic Ferment Found Normally in Tissue Secretions, Lancet **1**:217, 1929.

22. Borghi, B.: Bactericidal Properties of Tissues, Boll. d. Soc. ital. di biol. sper. **3**:545, 1928.

23. Mazzetti, G.: Behavior of Anthrax Bacilli in the Muscles of Guinea-Pigs Killed by This Organism and Subjected to the Temperature of Melting Ice, Atti. d. r. Accad. d. fisiocrit. in Siena **2**:263, 1927.

24. Ridley, F.: Lysozyme: An Antibacterial Body Present in Great Concentration in Tears and Its Relation to Infection of the Human Eye, Proc. Roy. Soc. Med. **21**:1495, 1927.

disappear. The rate of lysis is affected by H-ion concentration, the temperature, and the salt content.

METHODS

On account of the extremely small amount of secretion in the normal sinus, it was found necessary to work with small quantities. In one experiment, it was found difficult to secure as much as 0.01 cc. of undiluted secretion from the excised membrane of the maxillary sinus of the rabbit. Capillary pipets, drawn out to hold 0.01 cc. in a length of from 10 to 13 cm., were found suitable for the purpose. Calibration of the pipets was done in each instance by determining the length of bore that was filled by exactly 136 mg. of mercury. A mark was etched at the point.

Fleming,[25] in some work on the measuring of small volumes with capillaries, found the accuracy of such measurements quite comparable to measurements with ordinary pipets. Using pipets of from 62 to 87 mm. in length and with a capacity of 10 c.mm., some of which were coated with paraffin inside and outside, the error from "wash" as determined by titration of alkali delivered was found to be 2.2 per cent. The error due to inaccuracy in drawing to the mark was found to be 0.16 per cent in the pipet coated with paraffin and 0.43 per cent in the ones on which paraffin was not used. Even 5 c.mm. could be measured quite accurately.

In most experiments, petri plate counts were used in determining the number of bacteria present. A small amount of broth was placed in the bottom of the plate and the capillary pipet thoroughly rinsed in it. A modification of the Frost little plate technic was used in some of the preliminary experiments.

"Sinus washings" were secured by thoroughly rinsing a small amount of broth or saline over the surface of the membrane in situ. A capillary pipet with the end bent slightly was used for this purpose.

The organism used is one isolated from the air in the laboratory and designated as A_3. A cloudy suspension of this organism is completely lysed by egg albumin, with clearing of the fluid in a dilution of 1 : 1,000 within one hour at room temperature, and partially cleared by a dilution of 1 : 10,000. It is neither extremely susceptible nor extremely resistant to the action of lysozyme. In tubes in which partial lysis occurs, plating experiments show that some of the bacteria have been killed; some have been injured as indicated by a longer incubation to produce visible colonies, and some show no signs of injury. For experimental purposes a young two to eight-hour culture in plain broth was used. When saline was used for securing sinus extract or washings, the growth from a twenty-four-hour agar slant was washed off in saline and diluted to the desired density.

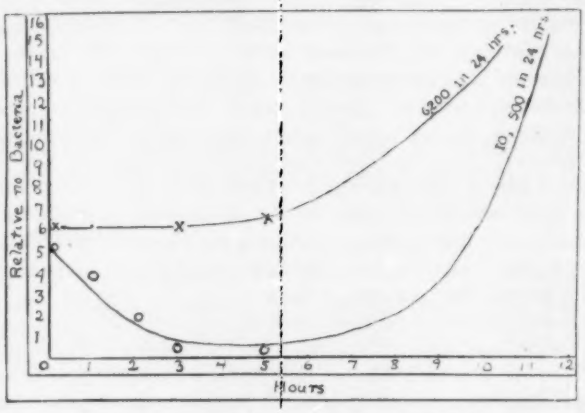
RESULTS

Bacteriostatic Effect of Sinus Secretions from a Rabbit.—The maxillary sinuses of a rabbit were opened aseptically and washed out with 0.4 cc. of beef extract broth. The secretions from two sinuses therefore were concentrated in 0.4 cc. of fluid. After this quantity was divided into two equal portions of 0.2 cc., one portion was heated in a water bath to 80 C. for thirty minutes. A 0.1 cc. pipet calibrated

25. Fleming, A.: On the Accuracy of Measurement of Small Volumes of Fluid with a Capillary Pipet, Brit. J. Exper. Path. **5**:148, 1924.

to 0.01 cc. was used for measuring. Both tubes were then inoculated with one loopful of a young broth culture of A_3, care being taken to insert the loop the same distance into the culture each time. The same loop was used for all experiments. After given intervals of zero, one, three, five, and twenty-four hours, with incubation at 37 C., the cultures were plated out and the number of surviving bacteria determined.

A series of ten experiments were performed. A drop in number of bacteria in the unheated tubes was observed, which reached a maximum in from three to five hours. The bacteria then began to increase, reaching a high figure in twenty-four hours. In one instance, the number of bacteria after twenty-four hours was less than the amount of the original inoculum. The growth curve was swinging upward, however, with indications that a period of rapid multiplication would soon be



Effect of rabbit sinus secretion on lysozyme-soluble bacterium A_3.

reached. The heated secretions, on the other hand, showed little or no tendency toward this early drop in numbers. The viable organisms remained fairly constant in number for from three to five hours, and then increased with great rapidity within twenty-four hours.

The sinus washings from the rabbit, therefore, were decidedly more deleterious to the growth of lysozyme-soluble organism A_3 than was this material when it had been heated to 80 C. for thirty minutes. Two hypotheses may be offered as possible explanations of the late increase in the number of bacteria:

1. Those organisms in the culture that were sensitive to the inhibiting substance were killed early, and the remaining resistant strains began to multiply.

2. Some change was produced in the medium as a result of the presence of the bacteria which interfered with the activity of the inhibitory substance.

The results are readily explained on the basis of lysozyme, if the first hypothesis is assumed to be correct. Fleming [21] has shown that heat destroys lysozyme heated at 75 C. for thirty minutes. Also a culture is seldom sterilized by lysozyme except with a susceptible organism and a high concentration of lysozyme. There are usually a few resistant strains in a bacterial population that survive. It has been shown that a resistant strain may be developed from a susceptible strain by repeatedly subjecting it to lytic action.

The second hypothesis would also readly explain the secondary increase in numbers of bacteria if the inhibitory substance is lysozyme. Small quantities of alkali interfere with the action of lysozyme. Experiments were performed which show that the organism A_3 produced an alkaline reaction in the sinus washings that reached approximately p_H 8 within twenty-four hours. A combination of the two aforementioned factors acting together would produce conditions quite favorable for growth after temporary inhibition.

Other factors may enter into the reaction between the organism and its environment. It is well known that inoculation of a bacterium into a medium that is unfavorable for its growth and multiplication will result in a temporary decrease in numbers. The same reaction to a mild degree occurs in a favorable medium, especially if the organism is not in an actively growing state. The decrease in numbers was too marked in these experiments to be explained on this basis alone. Antibodies, such as bacteriolysins, might be present in the secretions. It is not likely, however, that they would be found for an organism of the air, and that sufficient complement would be present for their activity. Levene [26] has shown that weak alkali decomposes mucus. Sufficient alkali may be produced by A_3 to decompose the mucus and decrease the viscosity of the sinus washings, thus rendering conditions more favorable for growth.

The washings obtained contained many epithelial cells dislodged from the mucous membrane. Their presence is inevitable, since many cells are removed by the slightest touch. It is not likely that these cells would contain an inhibitory substance that is not also present in the secretions. Epithelial cells are normally present in certain numbers in sinus secretions, and their presence in slightly increased numbers cannot be considered of any special importance to the experiment. They may add something to the nutritive properties of the medium as the bacteria becomes adjusted to the environment.

This group of experiments shows that a considerable inhibitory effect is produced on organism A_3 by secretions from the sinus of a rabbit, beef extract broth being used as the suspending menstruum.

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26. Levene, P. A.: Hexosamines and the Mucoproteins, New York, Longmans, Green & Company, 1925.

Bacteriostatic Effect of Secretions from the Sinus of the Dog.—Eight experiments were performed, the same technic as that described for rabbits being used. The only variations consisted in the use of the frontal sinus instead of the maxillary, and of 0.6 cc. of washing fluid instead of 0.4 cc. The same test organism was used.

The results were not so constant as those secured when secretions from the sinus of the rabbit were used. With the initial number of bacteria inoculated into the tubes being taken as unity, a series of survivor curves was secured. Four of these were intermediate, and showed the number of bacteria remaining close to a constant level for from five to six hours and then a rapid increase to several hundred times the original number in twenty-four hours. Three curves showed an appreciable decrease in numbers for from one to six hours and then a slight increase to unity or beyond in twenty-four hours. One curve showed a constant increase in numbers from the beginning. Control tubes of plain broth inoculated in the same manner showed growth and multiplication beginning somewhat earlier than in the four intermediate tubes of mucus. Otherwise, the curves with the numbers of bacteria plotted against the time were very much the same.

The heated mucus control tubes showed a fairly constant number of bacteria for the first few hours and a marked increase within twenty-four hours. The growth curve corresponded closely to that of the four intermediate tubes of mucus.

A majority of the experiments in this series showed that washings from the frontal sinus of the dog constitute a medium that is almost as favorable for the growth and multiplication of organism A_3 as the nutrient broth itself. All of the dogs used in this series of experiments were killed by ether anesthesia, while the rabbits used in the previous series were killed by dislocation of the neck.

Sinus Secretions as a Culture Medium.—Experiments were performed to test the nutritive properties of secretions from the sinuses of the dog and the rabbit. The sinuses were washed out with 0.6 cc. of physiologic solution of sodium chloride instead of nutrient broth. Otherwise, the technic was the same. The saline washings were inoculated with lysozyme-soluble organism A_3, and platings were made at intervals to determine the number of bacteria present.

Two experiments were run, secretions from the sinuses of rabbits being used. They failed to support growth in either the heated or the unheated specimens. A rapid decrease in numbers occurred during the first five hours, followed by a gradual progressive decrease.

Secretions from sinuses of dogs, on the other hand, showed a slow progressive increase in the numbers of bacteria. The increase was not rapid or accelerating, as might be expected in a medium that is favorable

for growth. A decrease in nutritive properties occurred as a result of heating. This was indicated by an initial rapid drop in the numbers of bacteria and then a gradual decrease. A tube of a physiologic solution of sodium chloride plus A_3 showed about the same rate of decrease in numbers as the heated secretions during the first five hours; however, after that a slow increase occurred in the heated mucus, which was not evident in the saline.

Secretions from sinuses of dogs therefore contained sufficient nutrient properties to support a moderate growth of organism A_3. Heating the secretions rendered them less favorable for supporting growth. On the other hand secretions from the sinuses of rabbits failed to support growth whether they were heated or unheated.

These experiments show that heating the mucus does not change the physical properties in such a way as to render it more favorable for bacterial growth. On the contrary, it is made less favorable. Therefore, support is given to the idea that some specific heat-labile substance is responsible for the inhibition of growth produced by secretions from the sinuses of rabbits in the presence of a favorable growth medium.

Effect of Undiluted Secretions from the Sinuses of Rabbits.—The object of the experiment was to determine whether the dilutions used in the aforementioned experimental work were sufficient to reduce appreciably the antibacterial activity. Special capillary pipets were prepared similar to those already described, holding 0.01 cc. in about 10 cm. length, but with a small bulb blown just above the calibration mark.

The membrane was removed from the maxillary sinus of a rabbit and the secretion gently scraped off onto a sterile glass slide, by means of a fine bent capillary glass rod. To aid in removing the secretion and prevent drying out, 0.01 cc. of a physiologic solution of sodium chloride was placed on the membrane and renewed twice. A whitish slimy fluid was secured, which was drawn into the capillary to the 0.01 cc. mark with difficulty. An air space was then allowed in the capillary and a saline suspension of A_3 drawn into the 0.0025 cc. mark. The whole was then drawn up into the bulb, mixed, and blown out into the capillary, which was sealed at both ends in a flame. Two tubes of this kind were prepared, one from each maxillary membrane, and a saline control for each. The results shown in the following tabulation, expressed in millions of bacteria per cubic centimeter were secured.

	1 hour exposure	4 hour exposure
Mucus plus A_3	44	15
Saline plus A_3	42	13

Bacteria in original suspension, 66

These results indicate that the dilution secured when from 0.4 to 0.6 cc. of washing fluid is used to wash out the two sinuses is not

sufficient to prevent the full antibacterial effect of the secretions from the sinuses.

The high viscosity of the secretions from the sinuses has an important practical bearing. Walthard [2] has shown that an actively motile colon bacillus in cervical mucus had not moved beyond the point of inoculation after fourteen days. A very actively motile vibrio was observed by Goldsworthy and Florey [15] to come to a complete standstill on contact with mucus, which acts as a "sticky fly paper" for bacteria, holding them in place so that cilia and other antibacterial mechanisms of the mucous membrane can act more effectively.

Antibacterial Effect of the Salivary Secretion of the Dog.—The duct from the submaxillary gland of a dog was cannulated with the animal under ether anesthesia, and a sterile flask was arranged to catch the secretion. The chorda tympani was stimulated, and from 10 to 15 cc. of saliva was collected. Another flask was used to catch the secretion secured by stimulation of the cervical sympathetic. The lytic effect and the inhibitory action were determined, four lysozyme-soluble organisms and one lysozyme-resistant organism being used.

Growth inhibition was tested by making plates of plain agar, removing the agar from one half of the plate or from a strip down the center of the plate, and filling in the defect with a mixture of one-half agar and one-half saliva. Several plates of this type were prepared for the two types of mucus.

Lytic activity was tested by making dilutions of 1:10, 1:100, 1:1,000, 1:10,000, respectively, of the saliva, egg albumin in similar dilutions being used to control the results.

Table Showing the Antibacterial Effect of the Salivary Secretion of a Dog

	Lytic Activity				Growth Inhibition: Saliva	
	Albumin		Saliva			
	½ Hour	18 Hours	½ Hour	18 Hours	18 Hours	36 Hours
A_1	±	+	0	+	+	±
A_2	±	+	0	0	0	0
A_3	+	+	0	0	0	0
A_4	+	+	0	±	±	±
A_5	0	0	0	0	0	0

+ indicates complete lysis, ±, partial lysis and 0, no lysis.

Egg albumin was used as a standard to determine lysozyme susceptibility. It will be observed that the first four were completely dissolved, while the fifth was not affected by the albumin. There was very little difference in the results secured with the two samples of saliva, so the results are tabulated together. Inhibitory effects are expressed in the same manner as lysis.

The lysis with A_1 in saliva was complete in a dilution of 1:10,000 in eighteen hours, and inhibition of growth on agar plates was complete

also in the same period of time. All dilutions of saliva, plus A_4, became opalescent in appearance instead of clearing up completely. Also the growth of A_4 over saliva in plates was distinctly reduced in quantity. In eighteen hours there were only a few scattered colonies, but after several days standing, a fairly heavy growth developed. The other three organisms showed no detectable lysis or inhibition of growth on plates at any time.

These results are quite clearcut and cannot be explained, as has been the tendency in the past, on the basis of differences in lysozyme concentration. The same saliva shows complete lysis of organism A_1 in a 1 : 10,000 dilution and no lysis with organisms A_2 and A_3 in a dilution of 1 : 10. All three of these bacteria, on the other hand, are dissolved with almost equal ease by egg albumin, lysis being complete in a 1 : 10,000 dilution within eighteen hours and probably much earlier.

The following significant deductions may be drawn from this experiment, although further work should be done to confirm the results.

1. The dissolving of an organism by lysozyme from one source does not necessarily indicate that it will be dissolved by lysozyme from another source. The aforementioned statement of fact as shown by experimental results may be explained by: (*a*) multiplicity of lysozyme; (*b*) high sensitivity of lysozyme to changes produced in the medium by the bacterium. These changes may vary with differences in the medium.

2. The extent of lysozyme activity of an extract or secretion cannot be determined by testing its effect on a given bacterium.

Reference to the accompanying table shows that in searching for lysozyme-soluble strains of bacteria from the air, different groups would be selected with the use of egg albumin and dog saliva.

SUMMARY

Secretions from the sinuses of rabbits are shown to possess an appreciable antibacterial effect, in the first few hours, on lysozyme-soluble bacterium A_3 isolated from the air. Later, through interference with the inhibitory activity or development of resistance, a rapid multiplication occurs.

There was little or no inhibitory effect of the secretions from the sinuses of dogs on bacterium A_3. In fact, a moderate growth and multiplication was supported by these secretions when they were used as the sole source of nutriment. Such growth was not supported by the secretions of rabbits under the same conditions.

The results indicate that a variation may be expected in the antibacterial effects of the secretions from the sinuses of different species.

An experiment was performed which showed that of four organisms sensitive to the lysozyme activity of egg albumin, only two were sensitive to the antibacterial effects of dog saliva.

PERENNIAL HAY FEVER*

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The term "hay fever" is a misnomer, as the symptoms are not due to hay, and instead of fever, there is usually a subnormal temperature. This name was first applied to the disease by the laity, and as it has survived a century of usage, will probably never be discarded. Hay fever is of two types: (1) the seasonal, which is limited to some particular season of the year, and (2) the nonseasonal or perennial, with symptoms occurring more or less irregularly throughout the year.

Perennial hay fever has many different names, such as vasomotor rhinitis, hyperesthetic rhinitis and nasal hydrorrhea, and when known to be due to sensitization is spoken of as allergic rhinitis or atopic coryza. Although perennial hay fever is frequently encountered by the medical profession, it is usually poorly handled, and, as a matter of fact, is looked on by most rhinologists as a more or less hopeless condition. On the contrary, when patients with such a condition are properly studied from the allergic point of view, most of them can be entirely relieved.

SYMPTOMS

The symptoms of perennial hay fever are the same as those of seasonal hay fever, namely, paroxysmal sneezing and rhinorrhea, alternating with periods of partial or complete stoppage of the nose. The sneezing and rhinorrhea are usually worse in the morning, whereas the nostrils are more likely to close up at night. The nasal manifestations of hay fever are usually accompanied by ocular symptoms in the form of lacrimation, itching, burning and redness of the conjunctivae. Itching of the eyes, of the nose, far back in the roof of the mouth and deep in the ears is characteristic of the true allergic type of hay fever. In addition to the local symptoms, a feeling of depression, lassitude or even prostration is frequently complained of by sufferers from hay fever.

DIFFERENTIAL DIAGNOSIS

There are only a few conditions that might be confused with perennial hay fever, namely, recurrent head colds, sinus infection, nasal trouble due to reflex or mechanical causes and cerebrospinal rhinorrhea.

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Recurrent Head Colds.—Head colds almost always run a somewhat definite course, frequently starting with a burning sensation in the back of the throat, followed in twenty-four hours or less by sneezing and running of the nose. The nasal secretion is at first thin, clear and colorless like water, and is irritating to the skin around the nasal orifices and to that of the upper lip. This secretion later becomes thicker and turns yellowish, thus becoming mucopurulent. Head colds commonly involve the pharynx, larynx and bronchial tubes, thus producing, in addition to the nasal manifestations, sore throat, hoarseness, cough and expectoration, which never occur in uncomplicated cases of hay fever. A cold continues uninterruptedly for an average period of one or two weeks until it has run its course, whereas attacks of perennial hay fever may come and go suddenly within the space of a few hours. The nasal secretion in hay fever remains thin, clear and colorless throughout, unless there happens to be a complicating bacterial factor; furthermore, this watery secretion is definitely less irritating to the skin than is the secretion in ordinary colds. The definite itching of the eyes, nose, roof of the mouth and ears, which is commonly present in hay fever, is absent in colds. Colds are frequently accompanied by fever, malaise, loss of appetite, headache and aching of the back and limbs. In uncomplicated hay fever, the temperature is usually subnormal, although children may have fever with allergic rhinitis or asthma. Persons with colds usually attribute them to contact with other persons suffering from colds or to sitting in a draft, getting the feet wet or being chilled from some unusual exposure. Of course, true hay fever is never, in any sense, contagious or infectious, and the only way it may be transmitted to others is by means of a dominant hereditary influence on the offspring in passing on to them the allergic constitution.

Sinus Infection.—Sinus infection accompanied by nasal symptoms may be differentiated from hay fever by a careful nasal examination, revealing to the eye of an experienced rhinologist pus exuding from one or more of the sinus orifices or an inflammatory reaction about these openings. In addition to the intranasal examination, transillumination of the maxillary antrums and frontal sinuses and a roentgen study of all of the paranasal sinuses are invaluable aids in diagnosing sinus disease. Pain and tenderness may be present over the affected sinus, and fever may accompany the infectious process. Sinus infection may also produce a leukocytosis of the blood with a relative increase of the polymorphonuclear neutrophils, which never occurs in uncomplicated hay fever. Persons with sinus disease frequently notice that bending over causes the nose to discharge, and they may also complain of an unpleasant odor and taste coincident with the drainage of purulent material into the nose.

Nasal Trouble Due to Reflex or Mechanical Causes.—Marked deflections of the nasal septum making contact at one or more points with the

turbinates may produce symptoms simulating nonseasonal hay fever, such as sneezing, clear nasal discharge and stoppage of the nose. An important differential point in these reflex cases is the absence of itching of the eyes, nose, roof of the mouth and ears, which is so frequently present in true hay fever. Also, there is a noticeable lack of allergic conditions in the personal and family histories of these patients with reflex nasal symptoms. A couple of typical case reports will serve to illustrate the nasal reflex group.

Miss S., 46 years old, who consulted me in 1925, suffered from what she described as head "colds," which had recurred frequently during the preceding ten or twelve years. These so-called "colds" were not accompanied by sore throat, cough or expectoration. Her family and past personal histories were completely negative for asthma, hay fever, urticaria, eczema and other allergic manifestations. She had never noticed that foods, animals or anything else affected her or aggravated the condition in any way. Her eyes never itched. The nasal discharge, although a little thicker than water, was perfectly clear. A course of eight injections of vaccine, consisting of four treatments with stock and four with autogenous vaccine, failed to give any apparent relief. A submucous resection of her badly deflected nasal septum was then performed by a competent rhinologist, and this operation cured the chronic nasal condition.

Mrs. M., aged 35, who was referred to me in 1926, suffered from what she referred to as a combination of hay fever and head colds occurring throughout the year. Her nose became plugged up badly during the attacks, but did not itch. Her throat did not itch, and there was no redness or watering of the eyes. She had never had asthma, eczema or hives, nor had there been any such condition in the family. She had never noticed that foods, animals, plants, powders or drugs aggravated the condition. A large number of skin tests for protein sensitization were negative. An examination of the nose showed a badly deflected septum, and a submucous resection completely cured the nasal condition.

Chevalier Jackson, in speaking of the asthmatoid wheeze produced by intrabronchial foreign bodies, has wisely said that "all is not asthma that wheezes." I would add that "all is not hay fever that sneezes."

I was called in consultation to see Mrs. H., a physician's wife, who was suffering from intractable sneezing. Her family and personal histories were completely negative for any of the allergic diseases. She had no eye symptoms nor any itching of the mucous membranes of her nose, throat or ears. A careful nasal examination revealed the presence of an old pledget of cotton which had been left there through mistake by another physician during treatment for a different condition. Following removal of the previously overlooked cotton pledget, the sneezing promptly ceased.

Cerebrospinal Rhinorrhea.—Cerebrospinal rhinorrhea is a rare condition, whereas perennial hay fever is common. The victim of cerebrospinal rhinorrhea frequently complains of a feeling of pressure in the head, which is relieved by the discharge of a considerable amount of clear, watery fluid from the nose. As this watery discharge is cerebrospinal fluid, it contains sugar, which gives it a sweetish taste, and the

presence of this substance may be confirmed by means of Fehling's test, as is used in routine urinalyses. Furthermore, cerebrospinal fluid does not contain mucin, and consequently does not stiffen the handkerchief when it dries. On the other hand, in hay fever the nasal secretion is free from sugar, has a salty taste and contains mucin which stiffens the handkerchief on drying. The absence of paroxysmal sneezing and eye symptoms or itching of the nose, roof of the mouth and ears are other points differentiating cerebrospinal rhinorrhea from hay fever.

HISTORY TAKING

Hay fever may be due to many different causes, and an exhaustive history is of prime importance in locating the causative factor or factors in the individual patient. The method of taking a history in nonseasonal hay fever is the same as that in bronchial asthma, which has been fully dealt with in a preceding article.[1] I should like, however, to stress some of the more important points at this time. In taking a history, the physician himself should do the actual questioning, instead of delegating this time-consuming task to some assistant or secretary, as is frequently done.

What may be termed the allergic constitution, namely, the tendency or ability to become sensitive to some foreign substance, is inherited as a dominant trait. Therefore, if a patient with symptoms of hay fever gives a positive allergic family history, such, for example, as asthma, hay fever, eczema or urticaria in the antecedents, there is an increased likelihood that the condition is true allergic hay fever. Likewise, in a patient with symptoms of hay fever, a personal history of any other allergic condition greatly increases the probability that the hay fever is also due to some form of sensitization.

Itching of the eyes is a most important symptom in perennial hay fever, as it strongly suggests sensitization to some air-borne substance that produces a conjunctival reaction simultaneously with that of the nasal mucous membrane. Several years ago, Walker[2] referred to the importance of itching of the eyes as a means of differentiating the sensitive from the nonsensitive type of hay fever. Itching of the nose and itching far back in the roof of the mouth and deep in the ears are also suggestive of sensitization. In a paper on perennial hay fever, Balyeat[3] even went so far as to call definite itching a pathognomonic symptom of sensitization.

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1. Brown, G. T.: History Taking in Bronchial Asthma, J. A. M. A. **88**:1693 (May 28) 1927.

2. Walker, I. C.: Frequent Causes and the Treatment of Perennial Hay Fever, J. A. M. A. **75**:782 (Sept. 18) 1920.

3. Balyeat, R. M.: Perennial Hay Fever: Diagnosis and Treatment, Based on the Study of Four Hundred and Forty-One Cases, South. M. J. **22**:492 (May) 1929.

The character of the nasal secretion may be helpful in differentiating the nonsensitive or bacterial type of perennial hay fever from the sensitive or allergic type, in that the secretion in the bacterial cases is likely to be thick and yellowish, in contrast to the thin, clear, watery secretion in the sensitive cases. The bacterial type tends to be worse in damp, rainy weather.

Although perennial hay fever, like bronchial asthma, may be due to many different causes, a carefully taken history will frequently supply invaluable information as to the offending substance or substances in the individual case. The following case report will illustrate this fact:

Mrs. J., who consulted me recently, stated that she had severe hay fever whenever she came in contact with dogs. Her symptoms were itching of the eyes, nose and ears and sneezing and running of the nose. Skin tests revealed a marked positive reaction to the protein of dog hair.

In this connection, I should like to paraphrase an old saying to read "The hair of a dog is sometimes worse than his bite." Not infrequently, patients state that petting a cat or being around horses produces symptoms of hay fever, and skin tests confirm the sensitization to the hair and dander proteins of these animals.

When persons with perennial hay fever find that their symptoms are aggravated by scented face powders, body talcums or sachets, it strongly suggests the possibility of sensitization to powdered orris root, which is a common component of cosmetics. Due to the fact that the air of theaters, ballrooms and other crowded places is usually laden with orris root, victims of perennial hay fever who are hypersensitive to this substance frequently state that they are made worse by going to such places. A history of a violent attack of hay fever following a dry shampoo is practically diagnostic of sensitization to orris root. Orris root sensitivity is such an important cause of perennial hay fever, especially in women, that I shall briefly report several illustrative cases.

Mrs. L., a young woman with severe hay fever, was referred to me by a nose and throat specialist in March, 1925. Although the condition occurred throughout the year, it usually became worse with the first warm weather and was severe all summer. The patient had not had hay fever as a child, and when it first started, the condition seemed more like an ordinary cold. During the attacks, she had severe spells of sneezing, often sneezing as many as fifty times before stopping. These spells were accompanied by a thin, clear watery discharge from the nose. The eyes became red and itched considerably, and she rubbed them a good deal. There was also itching deep inside the ears and nose. Although the throat felt constricted at times, she did not have shortness of breath or a cough. The hay fever caused her to feel listless most of the time. Sudden changes in the weather did not seem to affect the condition. She stated that powders made her sneeze, but felt that this was a penalty she must pay for her vanity. Skin tests were negative, with the exception of definite positive reactions to orris root protein and pure powdered orris root. This sensitization to orris root seemed to explain all of the

symptoms. The fact that the hay fever was worse in summer was undoubtedly due to the fact that she used more powder in hot weather. I advised the patient to substitute for the irritating French powders she had been using a powder that did not contain orris root. She was then given a course of hyposensitizing injections with gradually increasing doses of sterile orris root extracts. Since the completion of this treatment, more than five years before this paper was written, she has been entirely free from hay fever.

Miss B., aged 30, who had had perennial hay fever of seven or eight years' duration, was sent to me in 1925 by a nose and throat specialist. Prior to the onset of the hay fever, she had been subject to ordinary colds, but since then had had very few colds.

Parenthetically, it is my impression that persons with true perennial hay fever are much less susceptible to ordinary infectious colds than are normal persons. For instance, patients with perennial hay fever frequently tell me that they never have chest colds.

The individual attacks of hay fever, which occurred at least once a week, would usually last about a day and a half. Since the condition first started she had never been free from hay fever for more than two or three weeks at a time. She described the attacks as beginning with a sensation of having something in her eyes. Then her eyes and the roof of her mouth would start itching. She sneezed a great deal and had considerable nasal discharge, which was thin and clear like water. These symptoms would be followed by a headache which made her feel quite sick. This patient had originally lived in New York State, but her hay fever had been just as severe there as it was in Washington. Contact with cats, dogs or other animals did not bother her, and no particular food seemed to disagree with her. Likewise, grasses and weeds and dust had no apparent effect on the condition. She had noticed, however, that going to a theater or moving picture house would sometimes aggravate the hay fever, and that powders, perfumes and orris root shampoos would always bring on an attack. Skin tests showed a positive reaction to orris root, which checked perfectly with her history. Elimination of powders containing orris root, followed by a course of treatment with orris root, cured the patient of hay fever.

Miss S., aged 22, consulted me in 1927 for the relief of what she described as practically constant "colds" which she had had as long as she could remember. She sneezed most of the time, namely, about fifty times a day, and had considerable discharge from the nose. This discharge was thin and clear like water, and did not excoriate the upper lip or stain the numerous handkerchiefs she was forced to use. The eyes itched and were red and watery. Several ophthalmologists had treated the eyes, without results, and on one occasion she was told that she had "pink eye" in both eyes. She had no sinus trouble, headaches, cough or expectoration. Foods, animals, plants, flowers or weeds never seemed to bother her. Scented soaps caused sneezing, and crowded places made her feel nervous. Skin tests showed a 4 plus reaction to orris root. After all powders containing orris root had been eliminated, I gave her specific desensitizing injections, starting with 0.1 cc. of a 1:1,000 orris root extract and gradually increasing the doses at weekly intervals until a maximum of 2 cc. of a 1:10 extract was reached. Since the completion of this treatment, more than two years before this paper was written, she has been well.

When a person has nonseasonal hay fever in one particular house or locality and is free from symptoms in another place, in all probability

sensitization exists to something in the former environment which is absent in the latter. An interesting example of this is the case I reported about two years ago [4] of a man with severe perennial hay fever which left him only while he was away from home. Inquiry led to the fact that he had a pet parrot, which he had acquired prior to the onset of the hay fever. Skin tests revealed a definite positive reaction to the protein of parrot feathers, and disposal of the bird resulted in a prompt and permanent cure of the hay fever. It is hardly necessary to say that practically all other forms of treatment had previously been tried, including the services of a competent rhinologist, without any results. As is far too frequently the case, the allergist was the last resort.

In perennial hay fever, as in bronchial asthma, the inhalant or airborne allergens are far more important than the ingested substances, such as foods and drugs. Nevertheless, the possibility of sensitization to food must not be overlooked in studying such cases. When perennial hay fever is due to sensitization to food, there are likely to be other symptoms referable to the alimentary tract or the skin. The symptoms, therefore, that should arouse the suspicion of sensitization to food are swelling of the lips, itching or constriction of the throat, nausea, vomiting, abdominal pain, diarrhea, itching of the skin or hives, especially if they follow the ingestion of any particular food.

Among the foods, wheat flour is probably the most frequent offender, and may produce symptoms in two different ways: (1) by inhalation, as in bakers or housewives who do their own baking, or (2) by the ingestion of foods made from wheat flour, which enters into a large number of different articles of diet.

Hypersensitiveness to eggs is also important, owing to their widespread use and the fact that the sensitization is usually of such a high degree that the merest trace of egg in other foods is capable of producing marked symptoms.

NASAL EXAMINATION

Examination of the nose in perennial hay fever will frequently differentiate the allergic from the bacterial type. In the uncomplicated allergic type, the nasal mucous membrane is pale, bluish-gray and boggy or even water-logged in appearance; whereas in the bacterial type, the mucous membrane is red and inflamed, and pus is usually present. Of course, when the allergic type is complicated by a secondary bacterial infection of the nasal mucous membrane or the paranasal sinuses, the membrane loses its characteristic appearance. The value of a careful nasal examination in differentiating perennial hay fever from sinus infection and nasal conditions due to reflex causes has already been referred to.

4. Brown, G. T.: Perennial Hay Fever Due to Parrot Feathers, J. A. M. A. **92**:465 (Feb. 9) 1929.

SKIN TESTS

After a complete history has been taken and the patient's nose carefully examined, the next step is to make diagnostic skin tests. There are two different ways to make these skin tests, namely, (1) by the cutaneous or so-called "scratch" method of Schloss or Walker and (2) by the intracutaneous or intradermal method of Cooke. For simplicity as well as safety, the cutaneous method is easily the one of choice for routine testing. This opinion has been formed without prejudice, as I use both methods in my daily work.

The scope of this paper does not permit more than a brief description of the technic of skin testing. In the cutaneous method, the various allergenic substances to be tested are applied to small linear incisions or scratches made in the outer layers of the skin, either as fluid extracts or in the form of dry powdered preparations which are dissolved on the skin with tenth-normal sodium hydroxide. In the intracutaneous method on the other hand, minute quantities of sterile fluid extracts of the substances to be tested are injected between the outer layers of the skin by means of tuberculin syringes and small sharp needles.

The dry powdered preparations for cutaneous use, if kept in tightly corked bottles, will retain their potency almost indefinitely. Furthermore, the materials for cutaneous testing need not be completely sterile, although they should be reasonably so. All of the fluid extracts, however, have more or less limited periods of potency, and those used for intracutaneous testing must be absolutely sterile.

Skin tests may be applied to practically any part of the patient's body, as, fortunately for diagnostic purposes, when the nasal mucous membrane is sensitive to some particular substance, there is almost always a concomitant sensitization of the skin cells to the same substance. However, the flexor surfaces of the arms and forearms are the most convenient sites for the application of these tests, although some workers in the field of allergy prefer the back. My objection to the back is that the tissues there are firmer, and the urticarial wheals of positive reactions do not seem to stand out as clearly as they do on the arms.

When the cutaneous method is used, after about thirty minutes the tests are washed off with pledgets of cotton moistened with sterile water, care being taken that material is not carried from one test site to another. The reactions are then measured or interpreted, and a complete written record made of the results. The manner of interpreting and recording the reactions is the same for both methods of testing. A typical positive reaction consists of an urticarial wheal with a definitely irregular outline, surrounded by a zone of erythema. Definite itching at the site of any of the tests is significant, and the patient should be questioned regarding this point.

I am opposed to the policy of testing every patient with all available allergens, for it is unnecessarily wasteful of time and materials. What tests to make should be determined by the history, diet and environment of the patient. There are certain substances, however, that are of sufficient importance to warrant their being used almost as a routine in testing patients with perennial hay fever. They are as follows:

Animal Epidermals: Horse dander, cat hair, dog hair, rabbit hair, cattle hair, chicken feathers, duck feathers, goose feathers and sheep wool

Foods: Wheat (whole), egg (whole) and milk (cow's)

Miscellaneous Substances: Orris root, dust (house), cottonseed, linseed meal and horse serum

Bacteria: Staphylococcus pyogenes-aureus, Staphylococcus pyogenes-citreus, Streptococcus hemolyticus, Streptococcus viridans and Micrococcus catarrhalis

Pollens: Short ragweed, giant ragweed, timothy, orchard grass, English plantain, rose and mugwort

Most of the aforementioned substances need no further comment. Even though a patient may deny any contact with animals, some of the animal epidermals are present in every home, in the form of feather pillows, hair mattresses, woolen blankets, felt hats, furs, etc.

In testing for sensitivity to house dust, both stock and autogenous dust preparations should be used. By autogenous dust preparations, I mean extracts prepared from dust from the patient's own house. Recent researches have led me to the opinion that the atopic substances in house dust, other than the well known air-borne atopens, are mold spores. Therefore patients who are sensitive to house dust should be tested also with the common molds.

Sensitization to cottonseed and linseed meal have been fully dealt with in separate articles.[5] Suffice it to say that these two substances are rich in protein, and may act by inhalation or ingestion to produce nonseasonal hay fever and asthma.

The possibility of hypersensitiveness to horse serum should be ruled out in every allergic person, in case the necessity for the injection of serum, such as diphtheria or tetanus antitoxin, should present itself in the future.

Reactions to tests with bacterial proteins are almost always delayed, so such tests must be interpreted about twenty-four hours following their application, in addition to the usual thirty minute inspection. The question of the value of bacterial protein tests has been discussed in a preceding article,[6] and need not be considered in this paper.

5. Brown, G. T.: Cottonseed and Kapok Sensitization, J. A. M. A. **93**:370 (Aug. 3) 1929; Linseed Meal Sensitization, Ann. Int. Med. **4**:601 (Dec.) 1930.

6. Brown, G. T.: Bacterial Vaccines in Asthma, Am. J. M. Sc. **171**:94 (Jan.) 1926.

Although roses are pollinated by insects, patients with perennial hay fever occasionally give the history of having definite symptoms whenever they come in contact with roses. Skin tests show rose pollen to be the dominant or only reactor, and treatment with rose pollen extract relieves patients with this type of hay fever.

Some of the commercial protein preparations are excellent, and others are worthless. The only satisfactory method of determining the potency of these materials is by testing them on the skin of persons known to be sensitive.

Passive Transfer.—According to the method first described by Prausnitz and Küstner,[7] if blood drawn from the vein of an allergic person is defibrinated, centrifugated and sterilized by Berkefeld filtration, and then a drop or two of this blood serum is injected intradermally into a normal nonsensitive person, the specific sensitization of the donor will be passively transferred to the skin site of the local injection made into the recipient, as may be demonstrated by skin tests applied to this site. The reacting bodies present in the blood of an allergic person have been termed atopic reagins by Coca and Grove.[8] Therefore, the blood of a person with allergic hay fever, differs from that of a normal nonsensitive person. This fact, taken in conjunction with the generalized sensitization of the skin cells of a person with allergic hay fever, demonstrates the constitutional nature of the disease, and thus clearly shows the folly of depending on purely local treatment or on operations on the nose.

Autogenous Vaccines.—By means of history taking, nasal examination and skin tests, patients with perennial hay fever may be divided into two classes, namely, (1) the allergic type and (2) the nonsensitive or bacterial type. In the nonsensitive type, and also in the allergic type when there seems to be a complicating bacterial factor, cultures are taken from the nasal secretion, and an autogenous vaccine is prepared from each of the organisms found in sufficient numbers to warrant further study. These autogenous vaccines are then tested intradermally on the patient, the ones that give positive reactions being used for treatment, and those that fail to react more than the controls being discarded. The method of preparing autogenous vaccines and of selecting the proper organisms by means of intradermal vaccine tests is the same in perennial hay fever as in bacterial asthma, which has been fully described in another article.[6]

Staphylococcus pyogenes-aureus is nearly always the predominating organism in the nasal secretion of these patients, and it is commonly found in pure culture.

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7. Prausnitz, C., and Küstner, H.: Studien über die Ueberempfindlichkeit, Centralbl. f. Bakt. **86**:160 (Aug.) 1921.

8. Coca, A. F., and Grove, E. F.: Studies in Hypersensitiveness: XIII. A Study of the Atopic Reagins, J. Immunol. **10**:445 (March) 1925.

MUCOUS MEMBRANE TESTS

Patients are occasionally encountered who have a localized sensitization of the mucous membrane of the respiratory tract, without a coincident sensitization of the skin cells. Therefore if a patient with perennial hay fever gives a definite history of attacks caused by contact with some particular substance, and yet cutaneous and intradermal tests with this substance are completely negative, ophthalmic or intranasal tests should be done with the suspected allergen. The ophthalmic test is satisfactory when the perennial hay fever is accompanied by definite itching of the eyes, indicating sensitization of the conjunctivae to the same air-borne substance that is responsible for the nasal symptoms. In the patients without definite eye symptoms, however, the intranasal test would be more suitable.

Ophthalmic Test.—In the ophthalmic test, a small amount of the substance to be tested, in a dry powdered form, is picked up on the blunt end of a toothpick and dropped on the conjunctival surface of the lower eyelid, the lid first being pulled down sufficiently to evert it a little. Instead of using the dry powder for the test, a drop or two of a sterile extract of the suspected material may be dropped into the eye by means of a hypodermic syringe. In either event, a positive reaction manifests itself within a few minutes by the following symptoms: itching and burning of the eye, lacrimation, reddening of the conjunctiva, and, owing to the passage of some of the allergenic material through the nasolacrimal duct, nasal symptoms on the corresponding side. The ophthalmic test is perfectly safe, as the reaction may be checked at any time by putting into the affected eye one or two drops of a 1:1,000 solution of epinephrine, which clears up a reaction as quickly as it appears.

Intranasal Test.—In the intranasal test, the material to be tested is dropped or sprayed into the nostrils, and a positive reaction is manifested by nasal itching and irritation, sneezing, rhinorrhea and stoppage of the nose due to edematous swelling of the mucous membrane.

BLOOD TESTS

Calcium.—Calcium determination is the most valuable blood test in perennial hay fever, and should be done almost as a routine on these patients, except in cases in which some definite sensitization seems to explain all of the attacks. In a previous study,[9] calcium determinations made on the blood serum of forty-three consecutive patients with perennial hay fever showed that 37 per cent had a definite calcium deficiency, 21 per cent showed a low normal amount of calcium and 42 per cent were normal.

9. Brown, G. T., and Hunter, O. B.: Calcium Deficiency in Asthma, Hay-Fever and Allied Conditions, Ann. Clin. Med. **4**:299 (Oct.) 1925.

Phosphorus.—Inorganic phosphorus determinations have been done on the blood serum of a number of patients with perennial hay fever, and although some of these have been a little below normal, I have not encountered any of the marked deficiencies in phosphorus reported by Sterling.[10]

Sugar.—The late Charles W. Richardson always contended that vasomotor rhinitis was due to the excessive ingestion of carbohydrates, and insisted that his patients with this condition should eliminate from their diet all starches and sugars, such for example as white bread and candy. This opinion is apparently refuted, however, by blood sugar determinations on patients with perennial hay fever, for in my experience these values have all been within normal limits.

Eosinophilia.—The percentage of eosinophils in the blood, as determined by differential leukocyte counts, may aid in differentiating perennial hay fever from the conditions already described that simulate it. A former study of eosinophilia in allergy[11] supplies the following data: Differential leukocyte counts made on fifty-five consecutive patients with perennial hay fever showed an average of about 7 per cent of eosinophils, being almost exactly the same in the sensitive as in the nonsensitive or bacterial type. On the other hand, differential counts made on twelve patients with recurrent head colds, in three instances complicated by sinus infection, gave an eosinophil average of only about 3 per cent. It is evident from these figures that recurrent head colds and sinus infection do not tend to produce an eosinophilia as does perennial hay fever.

BASAL METABOLISM

A moderate degree of hypothyroidism is not infrequently encountered in patients with perennial hay fever, and seems at times to bear some etiologic relationship. Therefore, the basal metabolic rate should be determined on all patients with perennial hay fever who have symptoms suggestive of hypothyroidism, such as a subnormal temperature and a slow pulse rate.

Hubert[12] referred also to hyperthyroidism as one of the etiologic factors in rhinorrhea and sneezing, but I cannot recall having encountered hyperthyroidism in any of my patients with perennial hay fever.

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10. Sterling, A.: The Value of Phosphorus and Calcium in Asthma, Hay Fever, and Allied Diseases, J. Lab. & Clin. Med. **13**:997 (Aug.) 1928.

11. Brown, G. T.: Eosinophilia in Asthma, Hay Fever, and Allied Conditions, J. Lab. & Clin. Med. **12**:1145 (Sept.) 1927.

12. Hubert, L.: A Study of the Mechanism and Treatment of Rhinorrhea and Sneezing—A Local Manifestation of Some Metabolic Disorder, with an Analysis of Thirty-Four Cases, Ann. Otol., Rhin. & Laryng. **33**:824 (Sept.) 1924.

TREATMENT

The treatment for perennial hay fever may be considered under two headings, namely, palliative and curative.

Palliative.—A nasal spray of some light mineral oil, such as liquid petrolatum, used two or three times daily, may prove helpful. The mineral oil, of course, has no medicinal properties, but acts mechanically to form a protective coating over the surface of the nasal mucous membrane, and is most effective when the hay fever is due to sensitization to some air-borne substance.

A 1 per cent solution of ephedrine alkaloid in oil, sprayed or dropped into the nostrils, combines the well-known shrinking effects of ephedrine on the mucous membrane with the protective and soothing properties of the oil. The ephedrine in oil solution is best used plain, but, if preferred, may be obtained tinted and scented with oil of rose or combined with menthol, thymol, camphor or eucalyptol. The oil of rose would, of course, be contraindicated for the occasional patient who is sensitive to roses, and the principal objection to the aromatics is the unpleasant sensation that may be experienced on breathing cold air following their intranasal use.

When a shrinking effect is required stronger than that supplied by the 1 per cent ephedrine alkaloid in oil preparations, a small quantity of 3 per cent aqueous solution of ephedrine hydrochloride or sulphate may be dropped or sprayed into the nostrils.

Ephedrine is superior to epinephrine for intranasal use in that its action is more prolonged, and there are no unpleasant after-effects. It is a well known fact that when epinephrine is used in the nose, the shrinking effect on the mucous membrane is frequently followed by a vasomotor reaction that is worse than the original condition.

When the hay fever is due to or complicated by bacterial infection, ephedrine may be advantageously combined with one of the newer antiseptics, such as metaphen or sodium ethylmercurithiosalicylate, used in the form of a nasal spray or drops. These combinations are commercially available under the names of metaphedrin, and ephedrine with merthiolate solution.

The use of ephedrine in the nose, not only affords temporary relief from the unpleasant symptoms attendant on nasal stoppage due to swelling of the mucous membrane, but by shrinking down the membrane favors ventilation and drainage of the paranasal sinuses. The various ephedrine solutions for use in the nose may be placed in the hands of the patient with perfect safety, as they are not in the least habit forming, which is more than can be said for the cocaine solutions that are so commonly, and I believe unwisely, prescribed for sufferers from hay fever. One case will serve to illustrate this point.

Miss M., aged 44, who had had severe perennial hay fever of about twenty years' duration, was referred to me in 1924 by a nose and throat specialist. She had been treated by three different rhinologists, and cauterization and submucous resection had been tried without relief. While relating the history, she told me several times that the only thing that gave her any relief was the use of a cocaine solution in her nose, and that all of the physicians she had consulted freely supplied her with this remedy. I asked her if she would stop the cocaine, providing I succeeded in curing the hay fever, and her reply was that she did not believe she could ever get along without it. While waiting in the reception room of my office for her first appointment, she temporarily disappeared, as I later discovered, to visit the offices of several other physicians in the same building in an effort to obtain more cocaine prescriptions. Inquiry of one of our local druggists revealed that this patient had been getting numerous prescriptions for cocaine from physicians all over town. Skin tests showed marked orris root sensitization to be the cause of the hay fever. Following the elimination of powders containing orris root and the institution of specific hyposensitizing injections, the hay fever showed definite improvement. In spite of this relief, however, she refused to give up the cocaine, and as I would not prescribe any for her, she discontinued treatment.

Some patients with hay fever have such sensitive noses that any form of local treatment produces an unpleasant reaction. For instance, the intranasal use of epinephrine, cocaine or mild silver protein is followed by a marked vasomotor reaction that causes the nostrils to stay plugged for hours. Operative procedures on such noses are contraindicated, as vasomotor reaction and scar tissue do not mix well.

Coming back to ephedrine, this valuable drug may also be administered orally in the form of the hydrochloride or the sulphate, every four to eight hours, as required for relief from hay fever. The dosage is the same as in other allergic conditions, and has been given in a former article.[13]

Curative.—The curative treatment for allergic hay fever consists of the elimination of the offending substances from the environment or diet, desensitizing injections or a combination of the two. In other words, the allergic person either has to keep away from the offending material or be made tolerant to it. When elimination is possible and is completely carried out, a perfect result may be expected. When sensitization exists to the dander, hair or feathers of any domestic animal or pet, the offending animal or pet should be disposed of, if not permanently, then at least for a sufficient length of time to permit a course of specific desensitizing injections. Everything that contains the offending animal epidermal should be removed from the patient's environment. It is easy to understand how sensitization to the protein of feathers may account for hay fever symptoms, when one stops to realize that most people spend about one third of their lives with their heads in contact

13. Brown, G. T.: The Treatment of Urticaria and Angioneurotic Edema, Ann. Int. Med. **3**:591 (Dec.) 1929.

with feather pillows. With some feather-sensitive persons, it is sufficient to eliminate feathers from the bedroom, but with others, it is necessary to get rid of all the feathers in the house; this depends largely on the degree of hypersensitiveness. It may not be amiss to report briefly one case of sensitization to feathers.

J., a boy, aged 12 years, was snuffling and blowing his nose most of the time, and would wake up every morning with one or both nostrils plugged. Skin tests showed definite sensitivity to feathers, and elimination of his feather pillows cleared up the nasal condition almost immediately.

In sensitization to foods, complete elimination of the offending foods from the diet is usually all that is required, but it is occasionally desirable or necessary to desensitize against wheat, egg or milk.

The treatment for orris root sensitization has already been mentioned.

The method of administering specific hyposensitizing injections has been described in previous papers,[14] and need not be restated here.

If elimination and specific desensitization fail to cure the patient entirely of hay fever, some form of nonspecific protein therapy should be resorted to, and in my hands, injections of concentrated peptone extract have given the best results. Injections of peptone seem to be most effective in patients with a constantly subnormal temperature. The dosage and method of administration of concentrated peptone extract have been described elsewhere.[13]

When reactions to cutaneous tests are obtained with stock polyvalent bacterial proteins, treatment with the corresponding stock polyvalent bacterial vaccines is indicated, and usually gives excellent results.

Treatment for the nonsensitive or bacterial type of perennial hay fever with autogenous vaccines selected by means of intradermal tests is identical with the corresponding form of treatment in bacterial asthma, which has been described in detail in another article.[6]

Calcium therapy has also been described in other papers.[15] The occasional patient who cannot take calcium lactate powder may be given one or two tablets of calcium gluconate, each containing 25 grains (1.62 Gm.), to be chewed thoroughly and followed with a glassful of water, three times a day on an empty stomach, preferably from one-half to one hour before meals. Ampules of sterile calcium gluconate solution are also commercially available for intramuscular or intravenous administration. This solution is definitely less irritating to the tissues than calcium chloride. I should also like to recommend viosterol 250 D and cod liver

14. Brown, G. T.: Protein Sensitization in Bronchial Asthma, Hay Fever and Allied Conditions, with Report of Writer's Own Case, Virginia M. Monthly **49**:188 (July) 1922; Late Spring or Summer Hay Fever in the District of Columbia and Vicinity, Ann. Int. Med. **1**:169 (Sept.) 1927; Footnote 5, first reference.

15. Brown (footnote 9 and footnote 13, first reference).

oil with viosterol 10 D in both calcium and phosphorus deficiency. As the cod liver oil with viosterol, in addition to the vitamin D, also contains vitamin A, which apparently increases the resistance of the respiratory tract against infections, it would be preferable to the plain viosterol in those cases in which there seems to be an infectious element. These viosterol preparations are best taken three times daily with meals, the average dose of the viosterol with cod liver oil being one teaspoonful, and of the viosterol, 8 drops from the standardized dropper supplied with the bottle.

Desiccated thyroid should be prescribed for the patients with hypothyroidism, in proper dosage to bring their basal metabolic rates up to normal.

In addition to the aforementioned treatments, everything possible should be done to improve the general health and resistance of the individual patient, such as the removal of all foci of infection, the treatment of secondary anemia and the correction of intestinal stasis and putrefaction.

SUMMARY

Although perennial hay fever is frequently encountered by the medical profession, it is usually poorly handled, and, as a matter of fact, is looked on by most rhinologists as a more or less hopeless condition. On the contrary, when patients with the perennial type of hay fever are properly studied from the allergic point of view, most of them can be entirely relieved from their hay fever.

In this paper, a comprehensive and satisfactory method of diagnosing and treating patients with perennial hay fever is described somewhat in detail.

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HAS TIC DOULOUREUX A DEFINITE ETIOLOGY?*

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I report here a series of eight cases in each of which there was a similar pathologic condition in the maxillary sinus on the affected side. The pathologic process was recognized only by means of antroscopic examination. All other examinations—roentgen and nasal examination and transillumination—gave negative results. My experience with this major trigeminal neuralgia prompts me to suggest a pathology that may explain the presence of pain, which is most intense.

Tic douloureux is not a rare disease and is said to be only slightly less common than sciatica. The three characteristics of the condition are: (1) the short duration of the pain; (2) its paroxysmal nature with complete relief between attacks, and (3) the fact that, with few exceptions, it is unilateral. Pain beginning as a dull ache and increasing in intensity and gradually subsiding is not major neuralgia. Any pain of more than two or three minutes' duration is not, as a rule, major neuralgia. If the patient has any difficulty in locating the pain exactly, or if the attack can be aborted by any mental process, it is not a true major neuralgia. Usually there is a small, especially sensitive area, often located on the side of the nose near the eye, that acts as a trigger point. There are no anesthetic areas. Remissions are characteristic. The paroxysmal character of major neuralgia should distinguish it from minor neuralgias due to dental causes, herpes zoster, acute sinusitis, glaucoma or other diseases of the eye.

Pathologic reports on the two types of sinusitis have invariably been similar. The bacteriology of the asymptomatic type has not been studied, and may be important.

I quote a report from Dr. Weller of the University of Michigan, whom I asked for a report on the difference, if any, in the microscopic pathology of asymptomatic and of chronic purulent sinusitis. I sent him a specimen taken in a case of the former condition. He reported: "Chronic sinusitis with marked edema of the mucosa. Less exudative inflammation than is usually seen. Organizing thrombus in small vein. I can see no essential difference between the process here and that usually seen. The lack of marked exudative inflammation would explain the brilliant transillumination."

* Submitted for publication, June 6, 1931.

Treatment has included practically every sort of drug. It has been reduced to three types: resection of the sensory root, injections of alcohol and peripheral neurectomy. The last method is, at present, little used since it is no more efficient than injections of alcohol.

In citing the following cases I wish to minimize the matter of treatment, as the few cases reported are no proof of the efficiency of a method, and the time that has elapsed since operation is hardly sufficient to warrant a definite conclusion. I wish, however, to stress the point that each patient examined presented a definite polypoid degeneration of the mucosa of the maxillary antrum on the side involved, and that each case was one of what I call asymptomatic sinusitis, that is, a condition in which the sinus was found to be entirely normal on roentgen examination, transillumination and intranasal examination. Whether the ethmoid plays any rôle in these cases I am not able to say.

REPORT OF CASES

Case 1.—A woman, married, aged 30, had been operated on in 1923. A Caldwell-Luc operation had been done on the right side two years later. She consulted me again on account of paroxysmal pain on the left side of the face, typical of major trigeminal neuralgia. Examination gave entirely negative results, and simple local treatment was advised. She returned after having had all the upper teeth on the affected side removed, and requested that a window be made, opening into the antrum. After some hesitation, this was done. The patient was not seen again for some time. When she did return, she said that she had been receiving treatments at the University Hospital without relief for about three months. The patient returned with a recurrence of the pain. side. This was finally agreed on, and, to my surprise, the sinus was found to contain a large amount of polypoid material. This was unfortunately not sent to the pathologist. She has had no recurrence of the pain.

Case 2.—A man, aged 35, a school teacher, had complained of paroxysmal pain in the right side of the face for seven years. He had consulted me two years previously, but no pathologic condition had been discovered. He had been examined at the University of Michigan Hospital and x-ray pictures had been taken on different occasions. A window resection under the lower turbinate showed the presence of polypi on antroscopic examination. A Caldwell-Luc operation was performed on July 16, 1930. The pathologic report by Dr. Warthin was: "Chronic hypertrophic polypoid hyperplasia of the mucosa." The patient is well at the time of this report. The case was of a rather mild type.

Case 3.—W. T., a widow, aged 68, had presented typical, severe major neuralgia in the right side of the face for one year. There was no evidence of maxillary sinusitis on transillumination. The examination of the nose gave essentially negative results. Ninety per cent alcohol was injected into the nerve, which gave relief, and she strongly urged that a radical operation be performed on the left A large window was made under the inferior turbinate. Antroscopy showed the presence of many polyps. There was no injection of alcohol at this time, although procaine hydrochloride was injected into the nerve at the time of the window resection. No specimen was removed. Up to the time of this report, ten months later, there has been no recurrence of the symptoms.

CASE 4.—A woman, aged 55, married, presented typical severe paroxysmal major neuralgia. She had planned to have a posterior root resection performed. The patient was seen in August, 1930. The condition had been becoming increasingly severe for three years prior to examination. The upper teeth were removed on account of the pain. Examination of the sinuses and nose gave entirely negative results. Procaine hydrochloride and alcohol were injected into the nerve. A window resection of the right maxillary antrum and antroscopic examination showed many polyps. The patient was relieved until November (four months later), when a second injection was made. She returned in December with recurrence and requested a radical operation. A Caldwell-Luc operation was performed in December, 1930. Dr. Larkums reported as follows: "Marked hyperplasia of the mucous membrane and degenerating, granulomatous polyps of the sinus mucous membrane; no evidence of malignancy." The patient has a small fistula into the mouth, the size of an ordinary wooden applicator, which has not closed at the time of this report.

CASE 5.—Dr. K., aged 52, for two years had had pain on the right side of the face of rather mild type but becoming worse. He had at intervals six roentgen examinations, all of which gave negative results as to a pathologic condition of the paranasal sinuses. He had the teeth extracted. Transillumination was brilliant. The septum was markedly deviated to the right. A submucous resection with a window opening under the lower turbinate was done. Antroscopy showed the presence of polyps. The pain was relieved for two or three months, but is beginning to recur.

CASE 6.—A man, aged 33, a World War veteran, had trigger point sensitiveness over the angle of the nose on the right side for one year. Several examinations by different physicians were made, but no pathologic condition was discovered. Transillumination was brilliant. No pus was found in the nose, and there were no nasal symptoms. A large window opening was made in the sinus. Antroscopic examination showed many polyps in the sinus cavity. The symptoms have been relieved up to the present time (two months after examination).

CASE 7.—A man, aged 55, suffered from extremely severe, typical major neuralgia. He was seen previously by Dr. Peet at the University of Michigan Hospital, who advised a posterior root resection. Examination of the sinuses and of the nose gave entirely negative results. Window resection under the inferior turbinate and antroscopic examination showed many polyps. An injection of alcohol was made, but relief from pain lasted only two weeks. A Caldwell-Luc operation without injection of alcohol was performed in March, 1931. There has been no recurrence up to the time of this report. Dr. Weller's report was on material obtained from this patient.

CASE 8.—Mr. B., a man, aged 60, gave a history of moderately severe major neuralgia for the seven years prior to examination. His examination, like those in the rest of the cases reported, gave completely negative results. A window opening was made, and antroscopic examination showed the presence of polyps. A Caldwell-Luc operation was done in May, 1931. A piece of the mucosa was sent to the Michigan State Laboratory for bacteriologic study. The report was: "Pure culture of Staphylococcus." The rest of the specimen was sent to Dr. Warthin at Ann Arbor for a pathologic examination. His report was: "Edematous polypoid sinusitis; hyaline thickening of the basement membrane; chronic inflammation; no neoplasm." At the time of this report the patient has no pain.

In operating on these patients, I am sure that the exenteration of the mucosa must be absolutely complete. It is possible that there is a dehiscence in these cases, and that the nerve is exposed in the sinus. In two of the cases reported the orbital floor was extremely thin, and the orbital periosteum was exposed during the exenteration. I am not sure but that the ethmoid should be exenterated at the time of the operation. I believe that, for the after-comfort of the patient, the incision is usually made too close to the median line. An incision 1 or 1½ inches (2.5 or 3.75 cm.) lateral to the median line is more satisfactory.

CONCLUSIONS

1. There seems to be a definite asymptomatic maxillary sinusitis with negative x-ray picture, brilliant transillumination, no pus in the nose and no nasopharyngeal catarrh.

2. In eight consecutive cases, the sinuses were macroscopically identical; that is, they all contained polyps. The pathologic microscopic reports on material removed were also identical and agreed with the macroscopic findings.

3. Eight consecutive cases with constant pathologic processes in the maxillary antrum of the affected side prove nothing, but their occurrence at least demands a careful scrutiny in all major neuralgias in which there is the possibility of a definite etiology in the sinus.

4. It seems impossible that a disease as severe as tic douloureux has no pathology.

5. The neuralgia may be due to a toxic condition of the sinus contents or to pressure on the exposed nerve of the second division through a dehiscence.

6. If there is a definite etiology, surely a logical procedure for a permanent cure is just around the corner.

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A DIFFERENTIAL DIAGNOSIS AND THERAPY OF ATROPHIC RHINITIS AND OZENA*

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In approaching the problem of atrophic rhinitis and ozena, one is confronted with two distinct diseases that have been considered throughout the literature as one and the same disease.

Until the time of Grünwald,[1] in 1890, the name of ozena was applied to practically all nasal conditions producing a foul odor. In this manner there were grouped under ozena, syphilitic ulcers of the nose, tuberculosis, nasal diphtheria and, in fact, every nasal condition characterized by a foul odor. When Grünwald observed that the accessory nasal sinuses were frequently the source of the profuse purulent and foul-smelling nasal discharges, he proceeded to consider ozena, which term was used synonymously with atrophic rhinitis, as the end-result of sinusitis. He attempted to refute the case reports of Fränkel,[2] who described ozena as a disease characterized by a triad of symptoms, a foul odor, atrophy and crust formation without loss of tissue substance. Michel, Grünwald and Hajek [3] showed that this symptom triad occurred also in syphilis, tuberculosis, foreign bodies, rhinoscleroma and leprosy. This discussion was carried to a point where practically any diagnosis of ozena not of sinus origin was questionable.

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* Submitted for publication, July 28, 1931.

* My previous articles relative to this subject are as follows: The Surgical Aspect of the Nasal Ganglion, New York State J. Med. **25**:929 (Oct. 15) 1925; Contributions to the Study of the Sphenopalatine Ganglion, Laryngoscope **35**:87 (Feb.) 1925; Sinusitis in Children, Am. J. Dis. Child. **36**:1020 (Nov.) 1928; Atrophic and Vasomotor Rhinitis, Arch. Otolaryng. **12**:689 (June) 1930; The Neurologic Aspects of Nasal Sinus Infections, ibid. **10**:337 (Oct.) 1929.

1. Grünwald, L.: Die Lehre von den Naseneiterungen mit besonderer Rücksicht auf die Erkrankungen des Siehund Keilbeins und deren chirurgische Behandlung, Munich, J. H. Lehmann, 1893; Der heutige Stand der Ozaena-Frage, Arch. f. Laryng. u. Rhin. **13**:250, 1902.

2. Fränkel, B.: Beitrag zur Rhinopathologie, Virchows Arch. f. path. Anat. **87**:285, 1882; **75**:45, 1879; Weitere Untersuchungen über Rhinitis atrophicans foetida, ibid. **90**:499, 1882.

3. Hajek, M.: Pathologie und Therapie der entzündlichen Erkrankungen der Nebenhöhlen der Nasen, Vienna, Franz Deuticke, 1909; Berl. klin. Wchnschr. **25**:659, 1888.

Lautenschlager,[4] in more recent times, has attempted to define atrophic rhinitis, which he synonymously called ozena, as a definite entity, but he has failed to give a definite pathologic conception. He has, however, offered a surgical procedure to remedy the so-called atrophic rhinitis. It is the purpose of this research to attempt to delineate ozena as a definite primary disease apart from atrophic rhinitis and independent of suppurative sinusitis.

In recognizing a disease of the nose, one must consider five distinct mechanisms that are possessed by it: olfactory, respiratory, pneumatizing, reflex sexual and endocrine. The various diseases will affect one or more of these to a greater or lesser degree. For instance, in sinus disease, the pneumatizing mechanism is chiefly affected and the therapy is directed to the area of the mechanism disturbed.

Of these five nasal mechanisms, usually only a few are involved. In ozena, however, all five mechanisms are profoundly affected; it is the only disease characterized in this manner. In atrophic rhinitis, only the respiratory mechanism is involved. This difference will be elaborated in subsequent paragraphs.

It is essential, therefore, to consider the nose in its development, to seek for a type of offender that can induce such widespread disturbance and to describe the exact pathologic changes produced.

EMBRYOLOGY

A glance at figure 1 shows clearly the division of the mechanisms of the nose which I have described. One sees three different appearing areas, each practically separate. The inferior turbinate and the thick mucosa of the nasal septum are structurally representing an erectile and elastic organ. The inferior turbinate has an independent cartilaginous center from which develops an independent bone called the inferior turbinate. The subsequent photomicrographs will show the cavernous blood channels surrounded by a rich network of elastic tissue capable of rapid filling and of equally rapid emptying. The mechanism thus resembles histologically in a remarkable degree the genitalia. The mucous glands are also distributed in a manner peculiar to the inferior turbinate and yet quite different from that of the middle turbinate. There is a profusion of serous and mucous glands with a predominance of the serous variety. Stroking the inferior turbinate with the probe is frequently sufficient to cause the mucous and serous glands to empty their contents on the surface of the membrane in small hemispheric

4. Lautenschlager, A.: Die Rhinitis atrophicans in Denker, A., and Kahler, O.: Handbuch der Hals- Nasen- Ohrenheilkunde, Berlin, Julius Springer, 1926, p. 604.

droplets. The warmth of the reflected light of the mirror will at times produce the same effect.

The middle turbinate shows quite a different picture. Instead of an organ that is structurally analogous to the genitalia, there is a pneumatizing mechanism with epithelial evaginations forming the thinly lined sinus

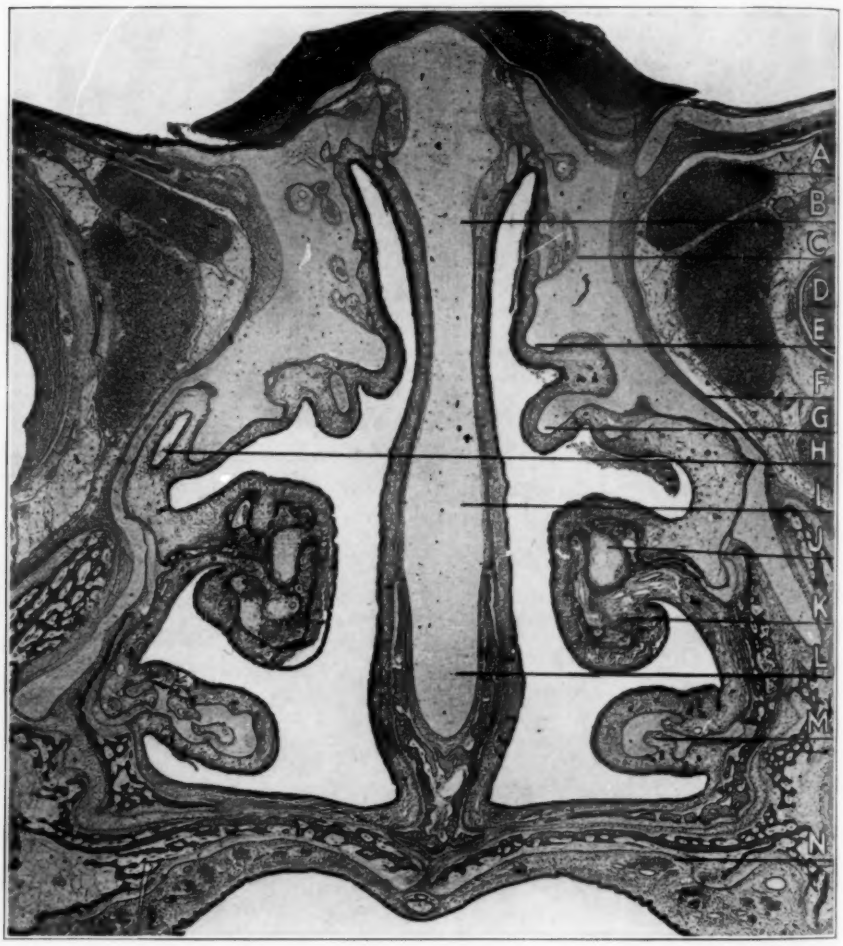

Fig. 1.—Section from the nose of a 5 months fetus. The tissue was normal; × 11. *A* indicates the orbit; *B*, the olfactory region; *C*, the ethmoid anlage; *D*, the optic nerve; *E*, the supreme turbinate; *F*, the cartilaginous capsule; *G*, the superior turbinate; *H*, the ethmoid; *I*, the respiratory region; *J*, beginning pneumatization; *K*, the middle turbinate; *L*, the septum; *M*, the inferior turbinate; *N*, the palate.

cells, which communicate with the portion of the nose devoted to respiration. All of these recesses have their openings under cover of

the middle turbinate in front, and above the middle turbinate behind. The profusion of glands is distinctly less than that of the inferior turbinate. In the middle turbinate, the relationship between mucous and serous glands shows a preponderance of the former.

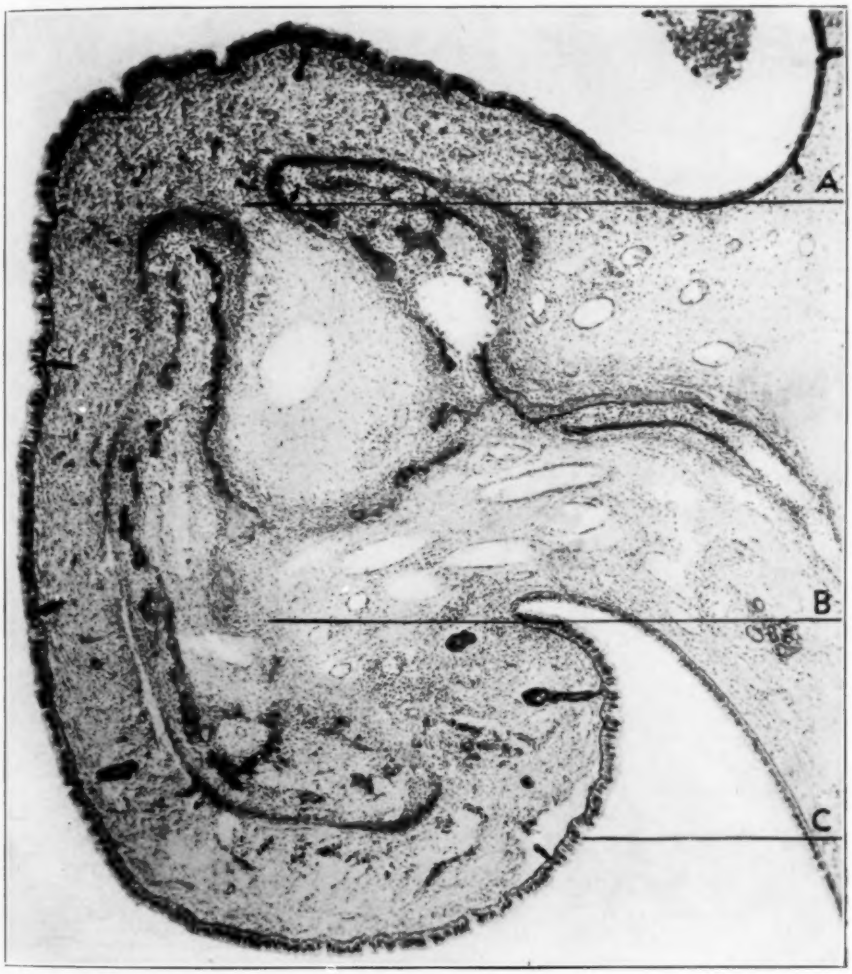

Fig. 2.—Pneumatization arising from the middle turbinate. Section of normal tissue from the nose of a 5 months fetus; × 55. *A* indicates evagination of an ethmoid cell; *B*, the middle turbinate; *C*, epithelium.

The pneumatizing mechanism from which are to develop the accessory nasal sinuses are clearly related to the middle and superior turbinates.

The area of the superior and supreme turbinates again appears different from the preceding mechanisms and represents part of the

olfactory mechanism. It is in this area that the specialized nerve fibers of the olfactory system are distributed.

The endocrine mechanism of the nose itself has received little or no attention. In the region of the alae of the vomer there has been differentiated by Haberfeld [5] a thin strip of tissue structurally characteristic of the endocrine glands to which the name pharyngeal pituitary

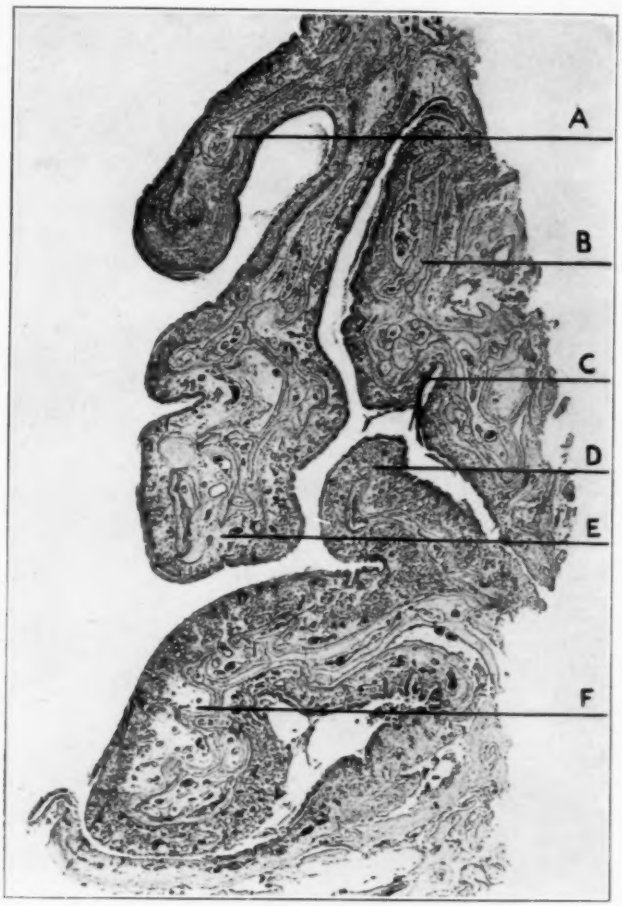

Fig. 3.—Section from the lateral wall of the nose of a new-born infant; × 11. *A* indicates the superior turbinate; *B*, the ethmoid; *C*, the hiatus semilunaris; *D*, the uncinate process; *E*, the middle turbinate; *F*, the inferior turbinate.

has been ascribed. The development of the anterior pituitary lobe from the Rathke pouch that is in the region that later represents the nasopharynx needs no elaboration here.

5. Haberfeld: Die Fachendach Hypophysis, Beitr. z. path. Anat. u. Path. **40**:51, 1909.

NORMAL HISTOLOGY

In order to have a ready basis for comparison of the pathologic entity that I desire subsequently to describe and to show the basis for the clinical changes occurring in ozena and in atrophic rhinitis, it is

Fig. 4.—Section from the middle turbinate; × 55. *A* indicates a vein; *B*, an artery; *C*, mucous glands; *D*, epithelium.

necessary first to present the normal histology of the inferior and middle turbinates.

Figure 7 shows the large number of secretory glands and their distribution throughout the inferior turbinate. The glands lie scattered below the epithelium and between a delicate elastic meshwork which,

when collapsed, is practically invisible, but, when filled with blood, forms cavernous spaces that greatly enlarge the turbinate. The enlargement or practical disappearance of this structure depends on the vasomotor supply. Figure 8 shows a larger magnification of the area of

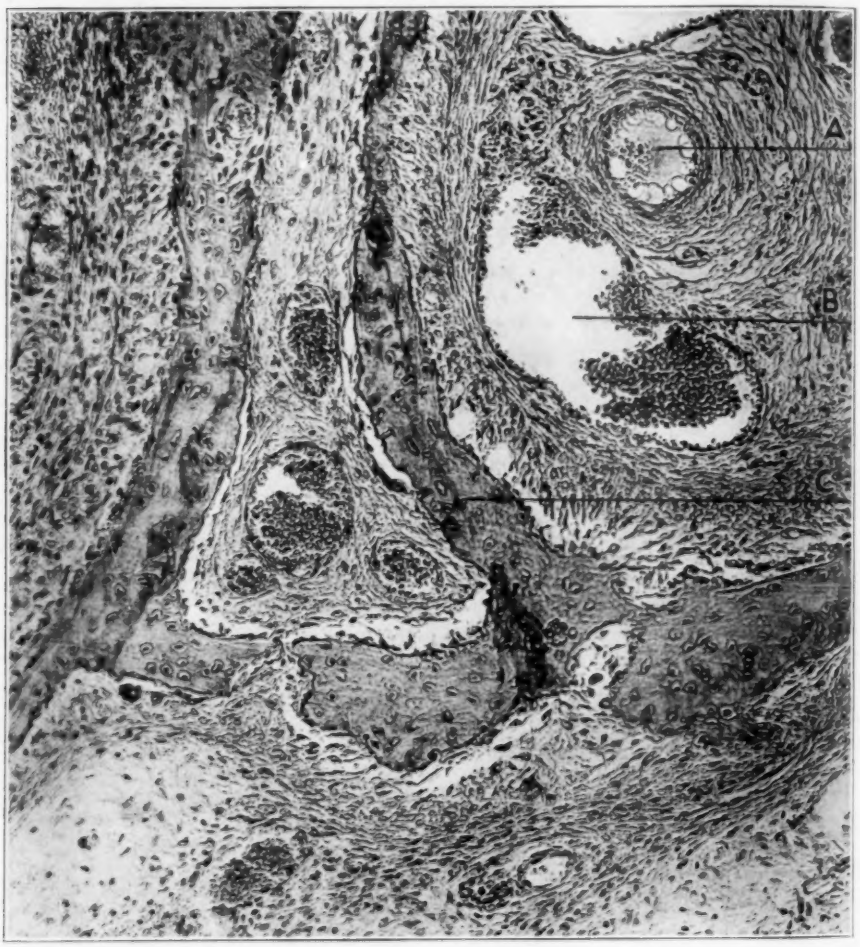

Fig. 5.—Section of the blood vessels of a new-born infant; × 150. *A* indicates an artery; *B*, a vein; *C*, bone.

glands with a comparison of the proportion of mucous to serous glands. The large clear cell glands are the mucous-producing and the darker staining are serous-producing.

Figure 9 shows the elastic tissue specially stained and the cavernous spaces distended.

Figure 10 shows the enormous enlargement possible in the elastic meshwork of the inferior turbinate.

Figure 11 shows the elastic tissue in one of the central arteries with the normal appearance of the intima, media and externa. It is this structure that I shall later use for comparison.

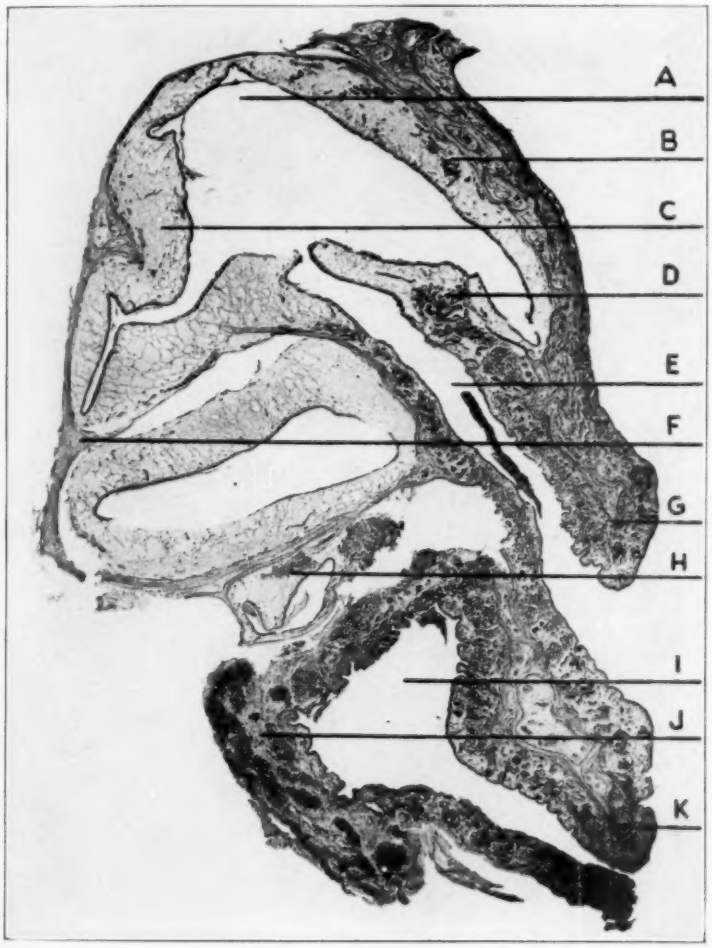

Fig. 6.—Section from the ethmoid labyrinth and lateral nasal wall of a child aged 7 years. *A* indicates the ethmoid; *B*, glands in the ethmoid mucosa; *C*, the mucosa of the ethmoid; *D*, secretory glands at the ethmoid ostium; *E*, the superior meatus; *F*, the lamina papyracea of the ethmoid; *G*, the superior turbinate; *H*, loose areolar tissue of the ethmoid mucosa; *I*, the middle meatus; *J*, secretory glands of the middle meatus; *K*, the middle turbinate.

Figure 12 shows the arterial structure.

Figure 13 demonstrates an artery and vein of the inferior turbinate.

Figure 14 reflects the pronounced difference between the inferior and middle turbinates. There is less distribution of glands; also absence of the cavernous spaces in the middle turbinate.

Figure 15 shows the elastica of the middle turbinate distributed chiefly in the periosteum of the bone.

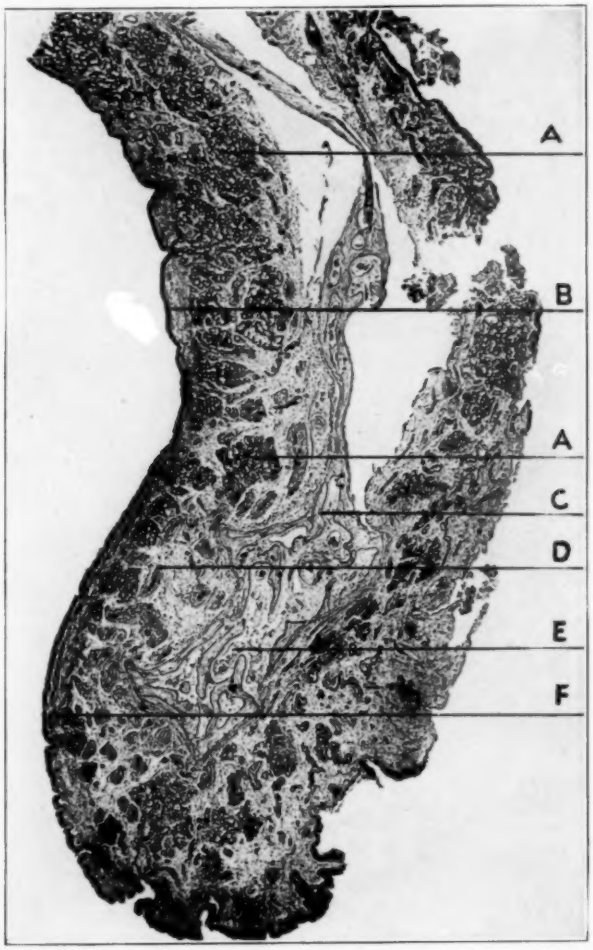

Fig. 7.—Section from a normal inferior turbinate. *A* indicates mucous and serous glands; *B*, epithelium; *C*, bone; *D*, the tunica propia; *E*, blood vessels; *F*, the basal membrane.

In figure 16, there is an increase of mucous glands in proportion to the serous variety in the middle turbinate. Observe the blood vessels and their rich distribution.

Bearing the normal histology in mind, let us examine the pathologic picture of atrophic rhinitis and ozena.

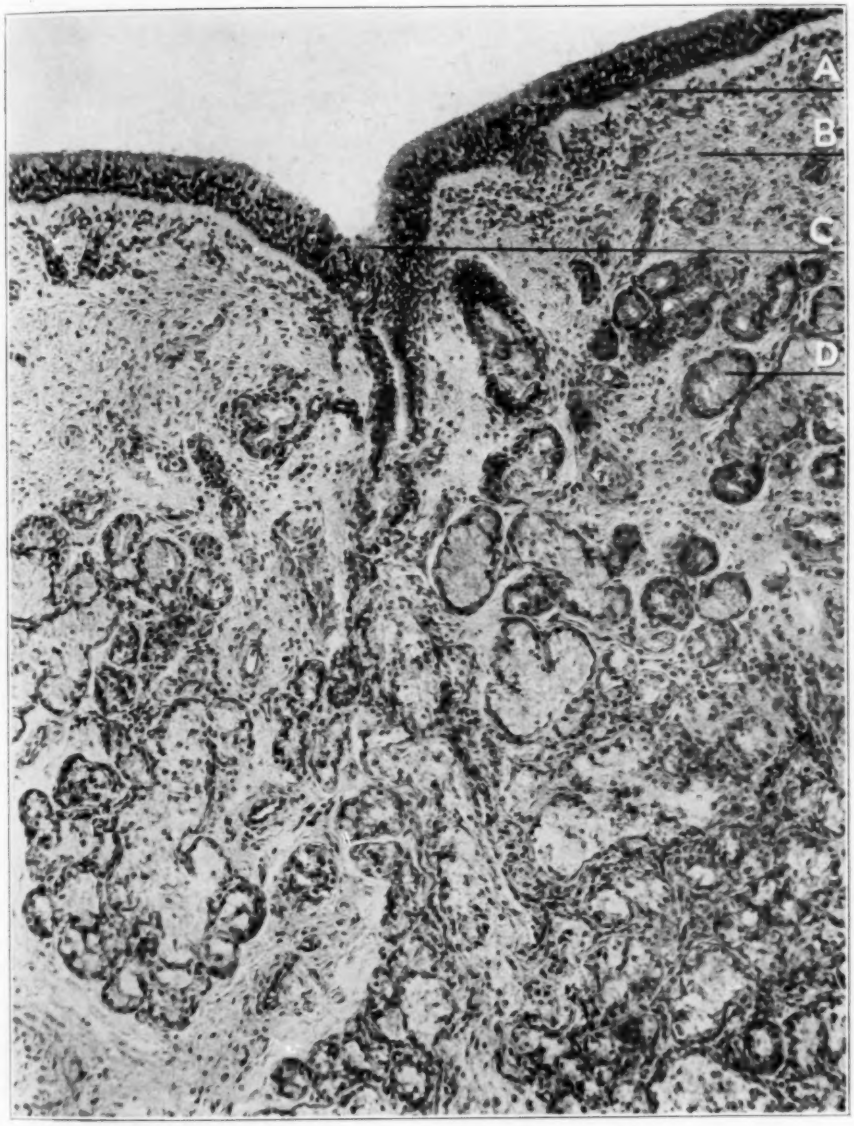

Fig. 8.—Section from the front end of a normal lower turbinate; × 125. *A* indicates the basement membrane; *B*, the tunica propia; *C*, epithelium; *D*, normal glands.

PATHOLOGY OF ATROPHIC RHINITIS

Microscopically, there is evidence of a chronic inflammatory process (figs. 17, 18 and 19). The epithelium shows areas of pronounced loss

Fig. 9.—Section from an inferior turbinate. Elastic stain; × 55. *A* indicates bone; *B*, elastic meshwork; *C*, blood vessels; *D*, cavernous spaces.

of columnar cells with apparent degeneration, clumping and loss of cilia. There is very little basement membrane below the epithelium, and even this zone shows round cell infiltration. In other areas there

are evidences of epithelial metaplasia with considerable round cell infiltration beneath them. The glands are scattered freely throughout the turbinate and show round cell infiltration going in and around the

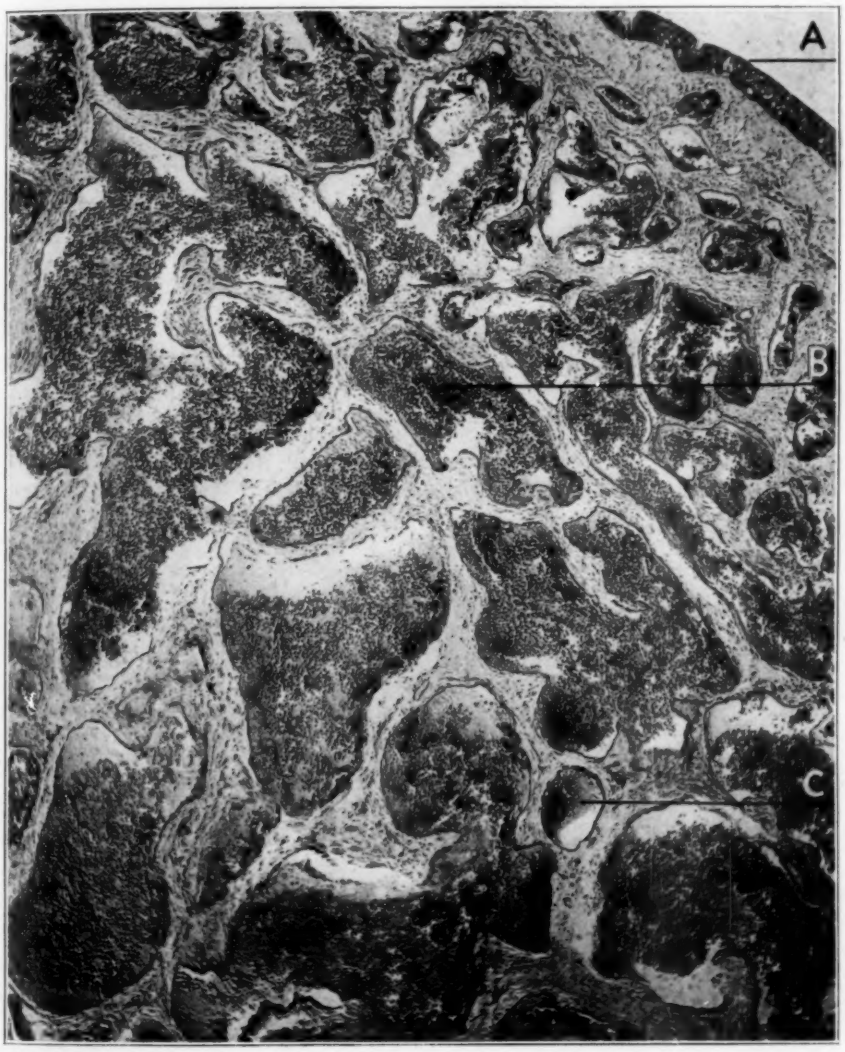

Fig. 10.—Section from cavernous spaces engorged with blood; × 55. *A* indicates epithelium; *B*, elastic meshwork dilated with blood; *C*, a vein.

acini. The lymphocytic invasion appears throughout all regions of the turbinate with definite dense grouping below the epithelium.

There is no very pronounced fibrosis. The disturbance is apparently one of lymphocytic infiltration. The glands retain their normal shape

and size except for the fact that they are surrounded by lymphocytic infiltration. There are evidences of newly formed vessels and granulation scattered throughout. The veins and arteries are normal in size,

Fig. 11.—Section from the lower turbinate, with a normal artery; × 55. *A* indicates the cavernous space; *B*, a nerve; *C*, an artery; *D*, elastic tissue; *E*, a vein.

shape and distribution. There is no fibrosis of the blood vessels. The lymphocytic infiltration fills the normal elastic and connective tissue meshwork.

It is obvious, therefore, that the condition is a chronic inflammatory process, characterized by loss of epithelium and lymphocytic infiltration of the connective and elastic tissue framework, thus interfering with

Fig. 12.—Section from the lower turbinate, with normal blood vessels; × 150. *A* indicates a vein; *B*, the media; *C*, the intima; *D*, an artery; *E*, the externa.

the expansile mechanism of the turbinate. The glands are not changed by scar tissue fibrosis but by round cell infiltration, and their ducts are apparently not impeded. There are slight areas of epithelial metaplasia that can hardly be termed hypertrophy.

Atrophic rhinitis, therefore, is not a blood vessel disease or a fibrotic process, but, rather, an infiltration of lymphocytes in reaction to chronic infection.

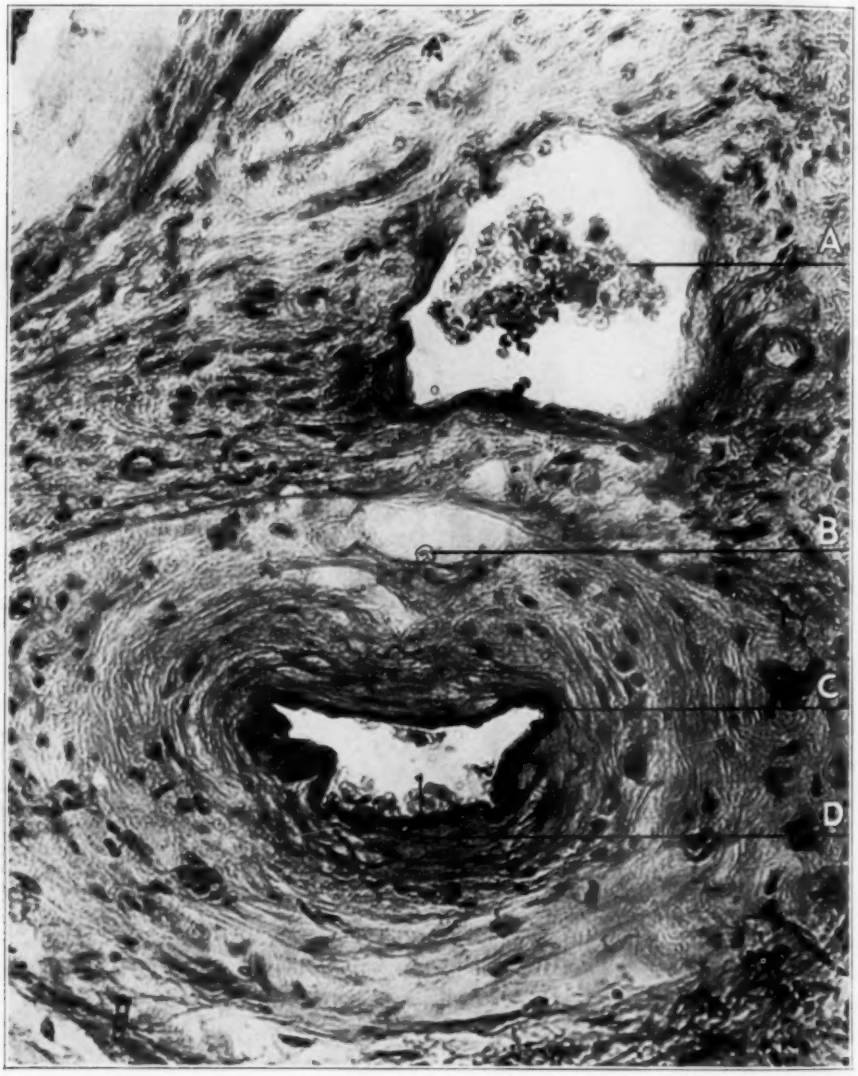

Fig. 13.—Section from the normal blood vessels of the lower turbinate; × 330. *A* indicates a vein; *B*, a nerve; *C*, intima stained for elastic tissue; *D*, an artery.

PATHOLOGY OF OZENA

Microscopically, this condition presents quite a different picture. The appearance is one of loss of function as a result of fibrosis and not

of infiltration. The tissue changes are such as would result from an interference with the blood supply rather than lymphocytic infiltration. The epithelium is degenerated and lost but not infiltrated. There are areas of epithelium appearing almost normal, particularly in the regions where the mucous and serous glands have been somewhat better retained. Below the epithelium one sees dense fibrous tissue that is practically

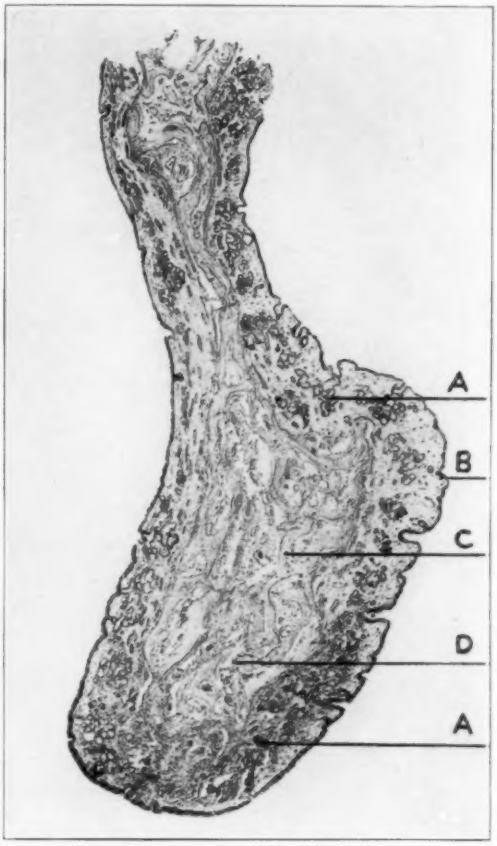

Fig. 14.—Section from a normal middle turbinate; × 11. *A* indicates glands; *B*, epithelium; *C*, bone; *D*, blood vessels.

scar tissue but without evidence of any lymphocytic invasion. There are no newly formed blood vessels and no granulations. Below this area of scar tissue can be seen distended glands the ducts of which have been obliterated by the dense fibrous tissue. The secretory cells are degenerating, but show no evidence of inflammatory invasion. The tissue presents the changes that would occur from interference with arterial circulation.

On observing the blood vessels, one finds a remarkable picture (figs. 20 to 30). Practically all of the arteries show pronounced thickening and fibrosis. The intima and media of the arteries form fibrous buds, projecting into the lumen of the vessel, causing, in many instances, complete obliteration of the vessel. Histologically, the picture is one of obliterating endarteritis. The general tissue fibrosis is evidently due to the loss in blood supply. This mechanism likewise affects the bony

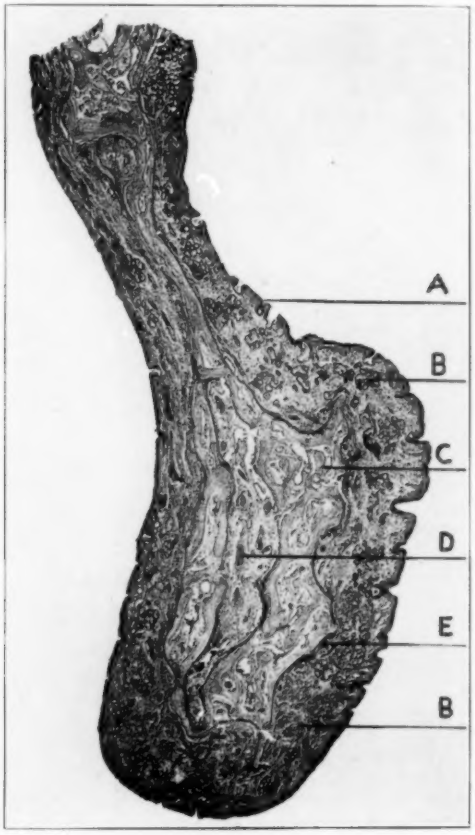

Fig. 15.—Section from a middle turbinate. Elastic tissue stain; × 11. *A* indicates epithelium; *B*, glands; *C*, bone; *D*, blood vessels; *E*, the periosteum.

framework of the turbinates, leading to fibrosis and resorption of the bone. The nerve structures also suffer from the general fibrosis and show degenerative changes.

The secretory glands have in a very large measure apparently degenerated and have been replaced by undifferentiated fibrous tissue. The serous glands which depend most on a rich circulation, have been

most affected, leaving chiefly the mucous-secreting glands. Some areas show an inflammatory reaction with lymphocytic infiltration, but only to a very moderate degree.

Thus it is seen that ozena is an entirely different disease histologically from atrophic rhinitis. It remains to show that it is a primary disease

Fig. 16.—Section from a normal middle turbinate; × 55. *A* indicates an artery; *B*, a vein; *C*, mucous glands; *D*, bone; *E*, serous glands; *F*, epithelium.

independent of suppurative diseases of the sinuses, whereas atrophic rhinitis is a disease secondary to nasal infection.

ROENTGEN FINDINGS

Figure 27 was taken in the case of Miss B. and requires differentiation between ozena and atrophic rhinitis. The nasal fossae show clearly

Fig. 17.—Section from a case of atrophic rhinitis; × 125. There was no involvement of the blood vessels. *A* indicates epithelium; *B*, dense round cell infiltration; *C*, diffuse infiltration of the mucous glands; *D*, an artery; there was no fibrosis; *E*, veins; *F*, diffuse round cell infiltration of the connective tissue meshwork.

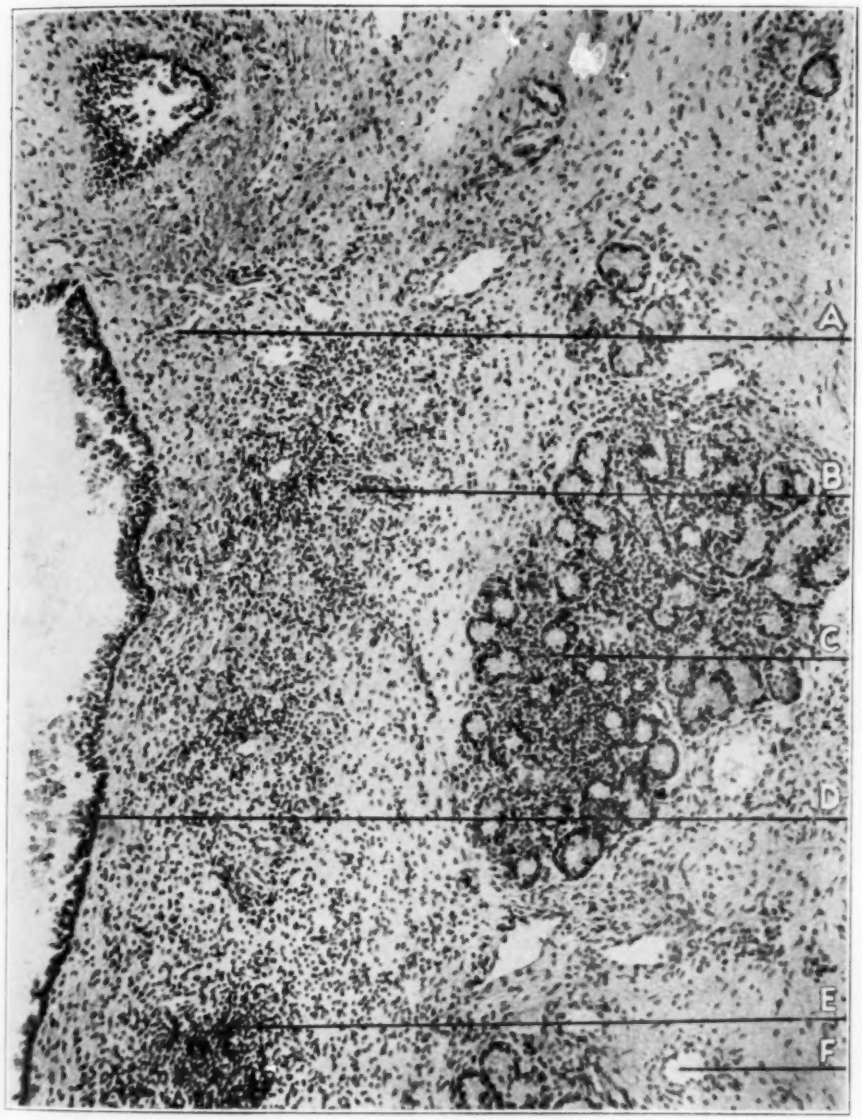

Fig. 18.—Section from a case of atrophic rhinitis, showing round cell infiltration; × 125. *A* indicates newly formed blood vessels; *B*, diffuse round cell infiltration; *C*, secretory glands densely infiltrated with round cells; *D*, epithelium, with a loss of columnar cells; *E*, dense lymphocytic infiltration; *E*, an artery.

Fig. 19.—Section from a case of atrophic rhinitis, showing lymphocytic infiltration; × 125. *A* indicates metaplasia of the epithelium with round cell infiltration; *B*, lymphocytic infiltration of the basement membrane; *C*, diffuse round cell infiltration; *D*, mucous glands; *E*, infiltrated serous glands; *F*, a rich supply of blood vessels.

the enormous amount of aeration and pronounced disappearance of the turbinates. The patient had not had any surgical operation at any time. In strong contrast to the loss of bony structures of the nasal fossae is a pronounced thickness of the bone surrounding the nasal fossae. The lateral nasal wall shows a considerable symmetrical increase in bony thickness, quite the contrary to what one would expect. Here ossification is proceeding coincident with atrophy such as occurs with blood

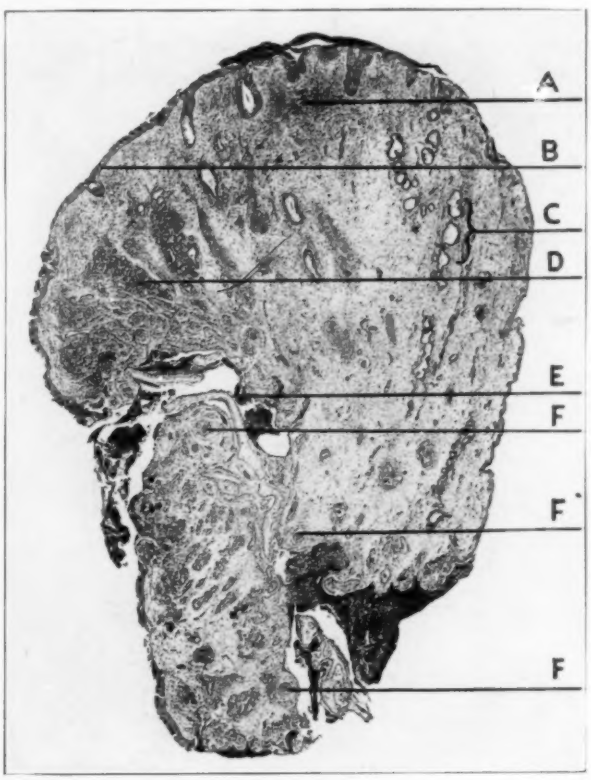

Fig. 20.—Section from the middle turbinate in a case of ozena; × 11. *A* indicates round cell infiltration; *B*, epithelium; *C*, dilated glands; *D*, mucous glands; *E*, bone; *F*, an artery.

vessel disturbances, occurring in Raynaud's disease and scleroderma. Not only the lateral wall, but also the walls of the sinuses and the nasal bones, participate in this increased ossification. Observe how clearly demarcated and heavy are the outlines of the maxillary and frontal sinuses and the orbit. The pneumatization of the sinuses also appears somewhat inhibited. The frontal sinuses are either small or absent as a rule. The antrums are likewise diminished in size. The vomer and

perpendicular plate are heavy. The nasal fossae are not diminished in size, but only appear so through loss of the structures appended to the lateral wall. The sinuses appear to be free from suppuration, and in control washings they prove to be free from purulent contents. One, therefore, is confronted with a picture of atrophy associated with increased ossification of the surrounding structures and an absence of suppuration in the sinuses. This is the picture that I ascribe to ozena.

Figure 30 is a roentgenogram taken in a case of atrophic rhinitis. It is the roentgenogram of the patient from whom the histologic slide of atrophic rhinitis was made (fig. 17). One sees the loss of turbinates, but here one finds no increase in ossification, but only atrophy. The lateral wall is extremely thin and was easily punctured. The actual

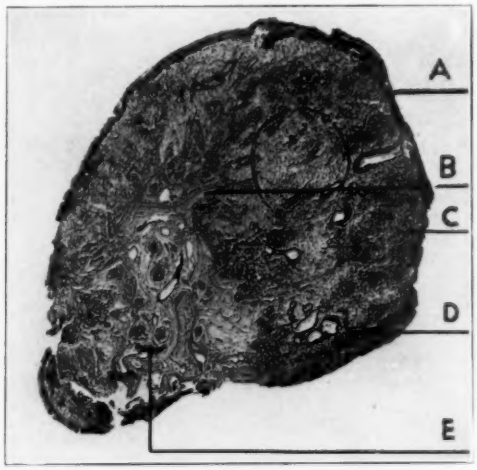

Fig. 21.—Section from the middle turbinate in a case of ozena; × 11. *A* indicates epithelium; *B*, bone; *C*, round cell infiltration; *D*, dilated glands; *E*, blood vessels.

space of the nasal fossae appears to have increased with this atrophy. The vomer appears extremely thin, although no surgery of the septum had been performed. The ethmoids were suppurating, and opening of the ethmoids was followed by free drainage with improvement. This is the picture I ascribe to atrophic rhinitis, frequently secondary to paranasal sinus suppuration.

Ozena is therefore a symmetrical primary disease of the nasal mucosa resulting from an obliterating endarteritis.

Atrophic rhinitis is a disease of the nasal mucosa, chiefly of the nasal fossae, secondary to chronic suppurative nasal infection and characterized by lymphocytic infiltration of the mucosa with chronic inflammatory changes.

CLINICAL OBSERVATIONS

The clinical discussions of this subject have given prolific rise to theories to such an extent that a review of these theories would be

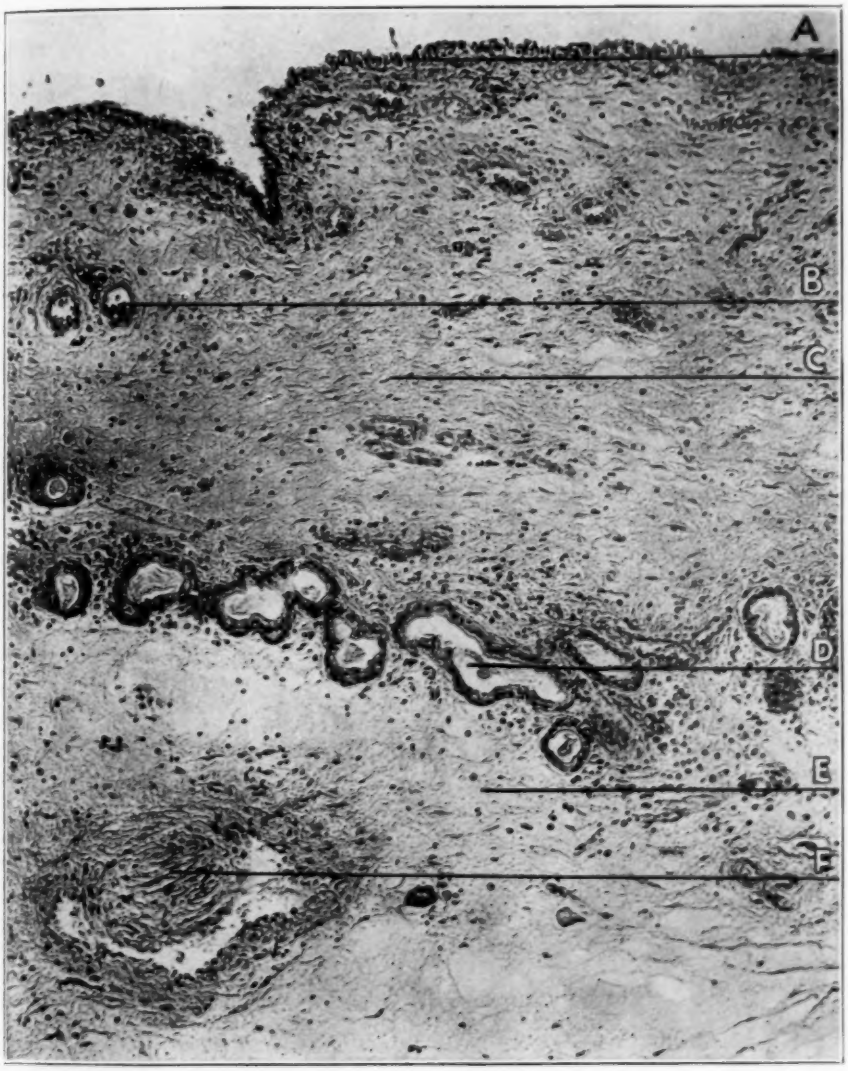

Fig. 22.—Section from the middle turbinate in a case of ozena; × 125. *A* indicates epithelium, with a loss of columnar cells; *B*, a vein; *C*, dense fibrosis; *D*, a distended secretory gland; *E*, fibrous tissue; *F*, a fibrosed artery.

tiring. All of these conceptions, however, were made without resort to an adequate study of the pathology, which resulted in the failure to differentiate atrophic rhinitis and ozena as two separate and distinct diseases.

Quite naturally, a common etiologic factor could not be found. The failure to separate atrophic rhinitis from ozena has also led to confusion of illustrations in the textbooks. Thus, Lautenschlager, in his article on

Fig. 23.—Section from the middle turbinate in a case of ozena; × 125. *A* indicates normal epithelium; *B*, a vein; *C*, a serous gland; *D*, fibrous tissue surrounding secretory glands; *E*, a mucous gland; *F*, a fibrous bud in an artery.

atrophic rhinitis in the Denker-Kahler Handbuch, has a beautiful picture of ozena to illustrate atrophic rhinitis. On the other hand, one finds in

the Bauer-Beck [6] "Atlas der Histopathologie der Nase und ihrer Nebenhöhlen" a typical slide of atrophic rhinitis labelled ozena. Lautenschlager, in the most recent article on the subject, presents drawings taken from Cholewa and Cordes' work [7] published in 1898. His own drawings of mucosa taken from the maxillary sinus show an obliterating

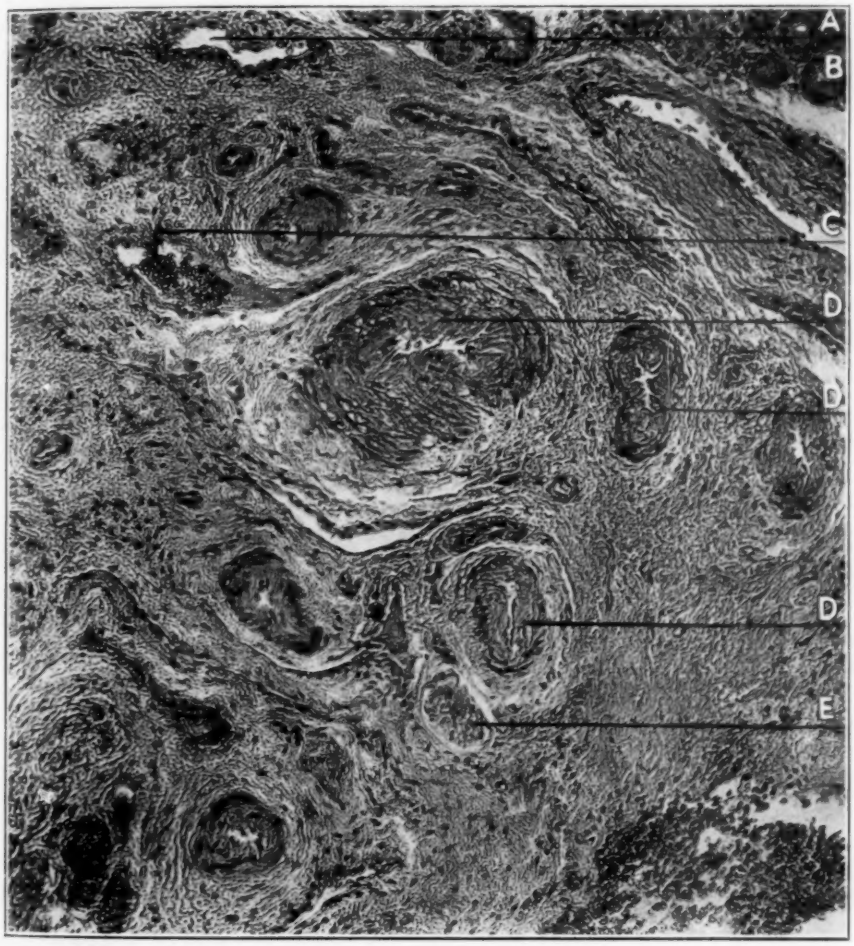

Fig. 24.—Section from the middle turbinate in a case of ozena; × 55. *A* indicates a vein; *B*, glands; *C*, an artery; *D*, a nerve.

endarteritis, yet he draws no conclusions from it, nor does it influence him in a conception for the therapy.

6. Bauer and Beck: Atlas der Histopathologie der Nase und ihrer Nebenhöhlen, Leipzig, Curt Kabitzsch, 1924, p. 30.

7. Cholewa and Cordes: Zur Ozaenafrage, Arch. f. Laryng. u. Rhin. **8**:18, 1898.

Ozena.—The clinical picture can be predicted from examination of the pathology. The inferior turbinate, embryologically developed to be an erectile organ composed of large cavernous spaces bounded by elastic tissue, fails to receive the necessary volume of blood because of the obliterating endarteritis. It, therefore, diminishes in size and partici-

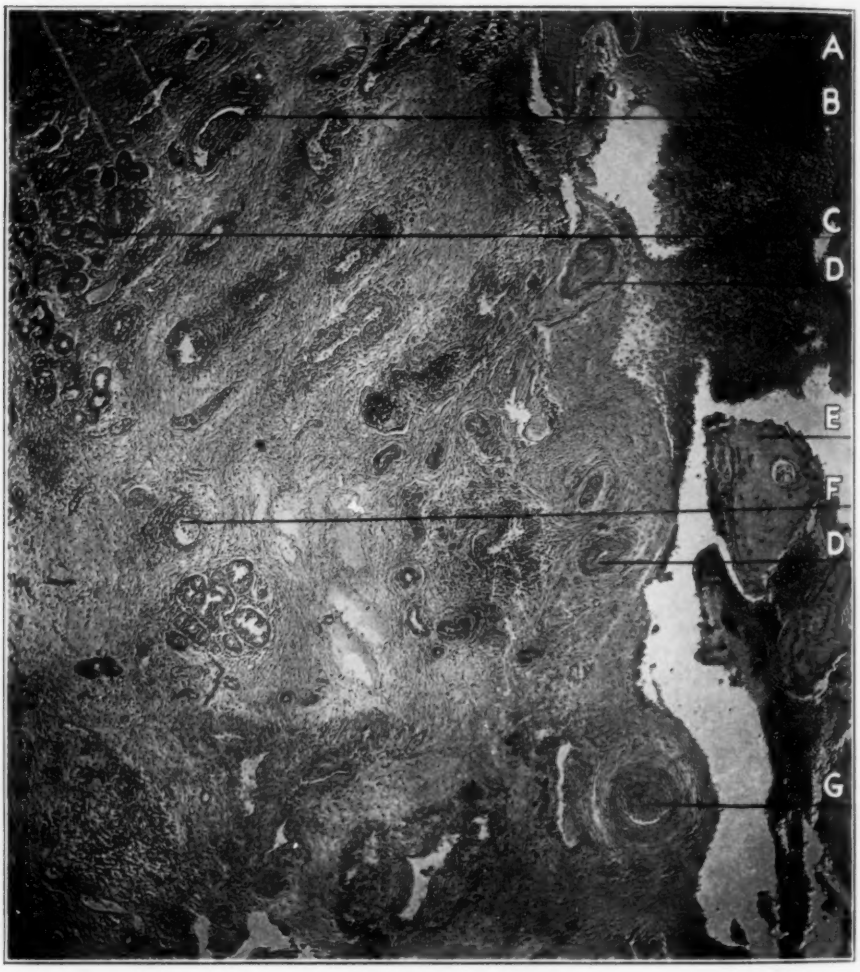

Fig. 25.—Section from the middle turbinate in a case of ozena; × 150. *A* indicates an artery; *B*, a partially obliterated artery or fibrous bud; *C*, degenerating glands; *D*, an artery; *E*, bone; *F*, a vein; *G*, an obliterated artery.

pates in the usual fate of tissues deprived of an adequate blood supply. The same fate befalls the middle and superior turbinates, as well as the mucosa of the lateral wall, with a resultant relative increase in space of the nasal fossae. The nasal secretion is likewise affected. The serous

glands that produce a thin nucleoprotein with a high water content are affected more by the deficient blood supply, and in advanced states there is profound loss of serous glands. The mucous glands are disturbed

Fig. 26.—Section from a case of ozena, showing obliterating endarteritis; × 125. *A* indicates bone; *B*, fibrosis of a vessel wall; *C*, proliferation of the intima and media, with obliteration of an artery; *D*, a nerve; *E*, a vein.

to a lesser degree because of the lesser requirements for water, and the secretion therefore almost entirely represents mucin.

This secretion, which might normally be moved by the cilia of the epithelium, when lying on a membrane almost denuded of cilia, tends to stick to the tissue until mechanically removed. During its period of attachment to the mucosa, it undergoes decomposition and secondary infection. Since the secretion is chiefly mucin, the odor is typically that of decomposing keratin and causes the characteristic nauseating foulness. This odor is not detected by the patient because the olfactory nerves have been practically destroyed by the fibrosis that binds the artery, nerve and vein. As the secretion is mucinous, it forms like a gelatin

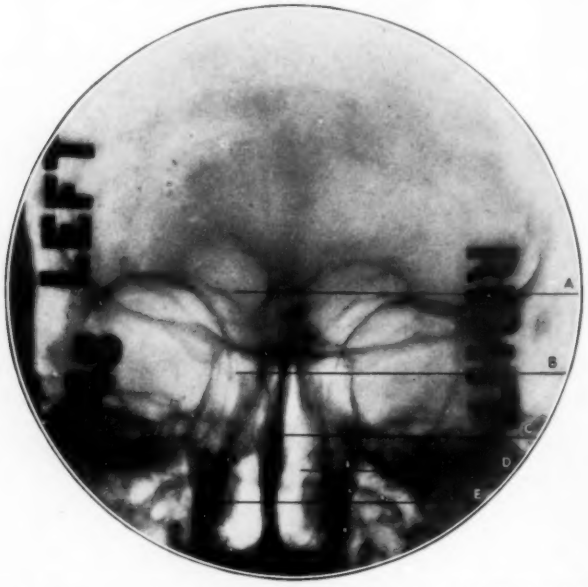

Fig. 27.—Roentgenogram taken in a case of ozena. *A* indicates inhibited pneumatization; *B*, clear ethmoids; *C*, ossification of the septum; *D*, atrophy of the turbinates; *E*, ossification of the lateral wall.

capsule around the turbinates and can be removed almost as a solid form of the nasal fossae.

The nasopharynx also participates prominently in this disturbance. The mucosa of the nasopharynx is rich in mucous and serous glands and is especially so in the region of the adenoid. The nasopharynx in these cases shows heavy crusting of the same character as that in the nose, which can be removed with difficulty. The secretory nerve supply to this area is also from the nasal ganglion coming by way of the nervus intermedius of Wrisberg and the greater superficial petrosal nerve.

Clinically, therefore, there is in ozena a disturbance of secretion such as would be incident to an obliterating endarteritis.

It is also interesting to note that in ozena there are occasionally blood vessel fluctuations that make one side much redder than the other. Those observing this mechanism have attributed it to hypertrophy. If it were hypertrophy, the color would be pale and bluish, rather than red. Histologically, I have not observed any evidences of hypertrophy.

These blood vessel fluctuations can be so great that Killian [8] and Baumgarten [9] have described cases that they have designated as ozena which, to their astonishment, when observed several weeks later, showed no signs of ozena.

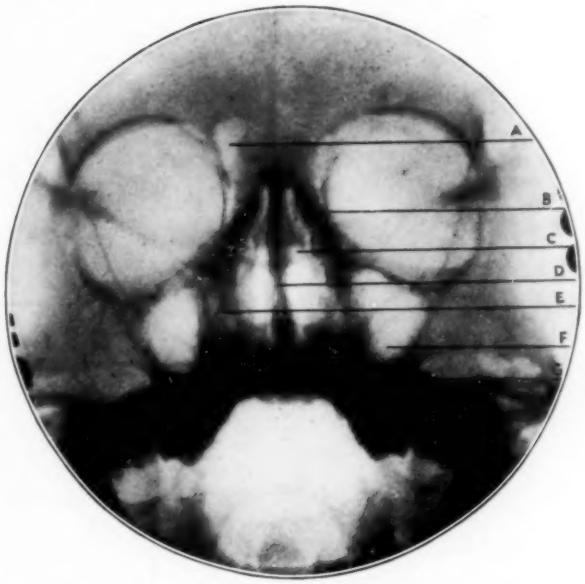

Fig. 28.—Roentgenogram taken in a case of ozena. *A* indicates inhibited pneumatization; *B*, ossification of the nasal bones; *C*, atrophy of the turbinates; *D*, ossification of the septum; *E*, ossification of the lateral wall; *F*, clear sinuses; *G*, ossification of the sinus wall.

Atrophic Rhinitis.—Following the observation of Grünwald that atrophic rhinitis was frequently associated with paranasal sinus disease, the conclusion was arrived at that the chronic suppuration was the direct cause of the atrophic rhinitis, and that the structures of the lateral wall of the nose atrophied as a result of the continuous trauma to the epithelium incident to their being in the pathway of nasal discharges coming from the sinuses.

8. Killian, G.: Die Nebenhöhlen der Nase in ihren Lagebeziehungen, Jena, Gustav Fischer, 1903.

9. Baumgarten, E.: Ueber die Frühformen der Ozaena, Arch. f. Laryng. u. Rhin. **22**:492, 1909.

Investigation of the sinuses in atrophic rhinitis shows the presence of suppurative involvement, but one does not find the quantities of pus ordinarily observed in nasal sinus suppuration. The character of the discharge is also different. It appears to be more like a mucopurulent exudate, thick in character and although foul in odor yet not so prominently of the keratin-reeking variety found in ozena.

The secretion in atrophic rhinitis appears to be a mucopurulent exudate as opposed to the secretion in nasal sinus infections in the hypertrophic variety, which seems more like a mucopurulent transudate.

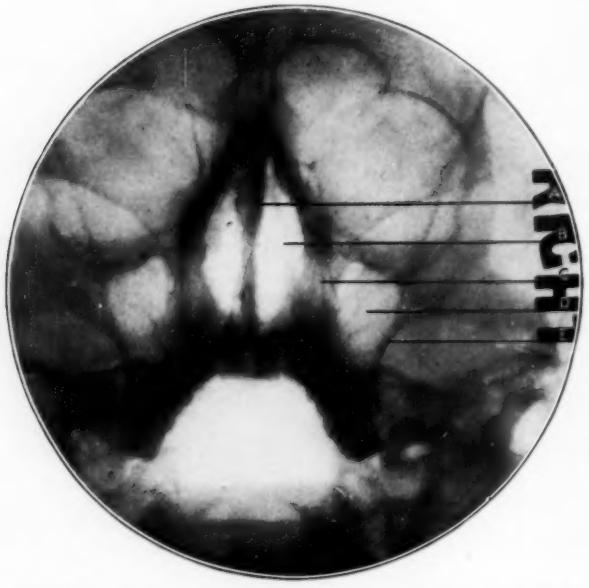

Fig. 29.—Roentgenogram taken in a case of ozena. *A* indicates ossification of the septum; *B*, atrophy of the turbinates; *C*, ossification of the lateral wall; *D*, diminished pneumatization; *E*, the thick sinus walls.

In atrophic rhinitis, the lateral wall of the nose participates actively in this exudative process; there is pronounced round cell infiltration with destruction of the epithelium. The infiltrative process interferes with the normal expansibility of the turbinate tissue, and as a result there is an increase in space of the nasal fossae. At this point, two mechanisms occur. One is of a mild form in which the destruction of epithelium is not pronounced and the secretions of the serous and mucous glands are not much impaired. In this case, the mucopurulent discharge is fluid and is moved off the mucosa by ciliary action, thus avoiding stagnation and decomposition of the secretions and producing the type of nonfetid atrophic rhinitis. The second type is that in which the epithelium has suffered severely and the secretory glands have been

impaired in their function by the inflammatory process. Here the secretions are more viscid and adhere to the mucosa. Decomposition and secondary infection of the discharges occur, with the resultant foul odor simulating ozena. The patients, however, can detect the odor and complain bitterly about it. The size of the nasal fossae in the nonfetid form may be as great or greater than in some of the cases of the fetid type, indicating that the size of the nasal fossae or the column of air passing through the nose plays no important part in either the crust formation or the odor. Thus an operation for narrowing the nasal

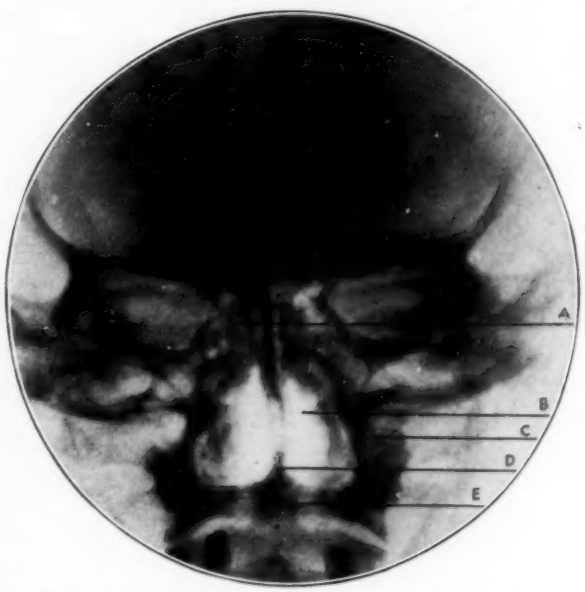

Fig. 30.—Roentgenogram taken in a case of atrophic rhinitis. *A* indicates the cloudy ethmoids; *B*, atrophy of the turbinates; *C*, atrophy of the lateral wall; *D*, atrophy of the vomer; *E*, atrophy of the floor of the nose.

fossae by extensive and destructive surgery has no rational basis anatomically, physiologically, pathologically or clinically and is not based on a conception of the etiology. In the light of the present study, the Lautenschlager operation and its modifications should be discontinued.

The etiologic factors of atrophic rhinitis, contrary to ozena, are infective. This is evidenced by the lymphocytic infiltration of the tissues. It remains to point out the difference between the usual nasal infection in sinusitis as opposed to that in atrophic rhinitis.

It is significant to observe that in nasal infections one frequently finds two types of infection: One can be classified as catarrhal and is characterized by a profuse discharge rich in watery content, containing

a rich supply of mucous and pus. This is the usual form found in sinusitis. The fluid elements probably occur as a transudate through the thin loose mucosa covering the large area of the paranasal sinuses and accumulating in the cavities to act as a source of chronic infection. There is, however, another type characterized by the formation of either an inflammatory membrane, as in nasal diphtheria, or a pseudomembrane, as in some forms of influenza, pneumonia, measles and scarlet fever. Here the lateral nasal wall suffers most, although the sinus mucosa participates. In scarlet fever particularly one finds this type also occurring, giving rise to the most severe form of rhinitis and sinusitis. One often sees areas of superficial necrosis in these membranous varieties with resultant loss of epithelium.

Since the popularization of the accessory nasal sinuses in the last generation, the nasal fossae have received but little observation. Rhinologists have been so impressed with the possibilities of the retention of secretions in the sinus cavities that they have almost ceased to consider the great potentialities of the turbinates and the lateral nasal wall for secretion. A glance at the section of the ethmoid and lateral wall of the 7 year child (fig. 6) will show that the secretory function is almost entirely vested in the turbinates and lateral wall. In the region of the sinus ostia, the glands are especially profuse. The sinus mucosa is very poorly supplied with secretory glands, but because of its loose structure it can act almost as a single-layered membrane for rapid diffusion and absorption of fluids. Thus, the essential histologic differences determine the variety of inflammatory reaction. A rhinitis implying inflammation of the nasal fossae must be given more thought. The severe exudative types of inflammation of the nose are chiefly diphtheria, influenza, measles, pneumonia and scarlet fever. In cases of atrophic rhinitis it is usually possible to elicit a history of a severe attack of one of these diseases. Atrophic rhinitis represents the end-result of a severe chronic rhinitis. One sees, therefore, that the effort to find a single type of organism is a fruitless search and the use of so-called specific vaccines and serums ungrounded. Whatever benefit is derived is essentially of the nonspecific protein type. The use of medicaments, such as dextrose, represents only the attempt to substitute bacterial fermentation in the purulent crusts rather than putrefactive decomposition.

DIFFERENTIAL DIAGNOSIS

It becomes apparent that in approaching the therapy for the two diseases the differential diagnosis must be made clear between ozena and atrophic rhinitis. The therapy in each must be directed against different etiologic factors.

In ozena, the diagnosis is made:

1. By roentgen demonstration of an increased ossification of the septum, the lateral wall and the sinus walls in conjunction with atrophy of the turbinates.
2. Inhibition in development of the nasal sinuses.
3. Increased mucin content of the secretion with a characteristic odor of mucin decomposition (similar to burning keratin).
4. Anosmia.
5. Histologic demonstration of obliterating endarteritis.

In atrophic rhinitis, the diagnosis is made by:

1. Roentgen demonstration of thin-walled sinuses, associated usually with suppurative processes. There is atrophy of the lateral wall and septum, particularly the vomer.
2. Normal-sized sinuses.
3. Purulent, rather than mucinous, character of the discharge.
4. Sense of smell may be diminished but is present.
5. Histologic demonstration of lymphocytic infiltration.
6. History of severe nasal infection in scarlet fever, measles, pneumonia or diphtheria.

THERAPY

The therapy for ozena is essentially to be directed toward the blood vessels. In considering an obliterating endarteritis occurring in youth, one must recognize that it represents a disturbance in equilibrium between vasoconstriction and vasodilatation. Overaction of the vasodilators is so frequently found occurring in the nasal mucosa in allergy and allied conditions in all ages that its counterpart, overaction of the vasoconstrictors, must also occur. Ozena represents this picture physiologically, pathologically and clinically, as allergeric conditions demonstrate overaction of the vasodilators. One can approach the problem of overaction of the vasoconstrictors in two ways, either by direct blocking of vasomotor control of the vessels or by chemical influence. In vasodilator states, the rhinorrhea can be stopped by blocking the vasomotor supply from the nasal ganglion and by the intravenous injection of calcium, which also tends to increase the coagulability of the blood.

In vasoconstrictor states, the dryness of the nasal mucosa can be similarly relieved by blocking the vasomotor supply from the nasal ganglion and the injection of manganese nucleinate intramuscularly, which diminishes the coagulability of the blood.

In considering the question of blocking of the vasoconstrictors, it is well to glance at the anatomy and physiology of the vasomotor nerves.

A brief review of the anatomy and physiology of the vasomotor nerves is helpful in understanding the rationale. Royle [10] first pointed

10. Royle, N. D.: The Surgical Treatment of Raynaud's Disease and Similar Conditions, M. J. Australia **2**:341 (Nov. 5) 1927.

out that vasodilatation followed the operation of sympathetic ramisection. It has been shown that there are two classes of vasomotor nerves, the vasoconstrictors and the vasodilators. The vasoconstrictors are supplied by the sympathetic nervous system, and the vasodilators are apparently supplied by nerves that travel with the sensory nerves but in the opposite direction. These have been called by Bayliss [11] antidromic fibers. The effect of cutting or blocking the sympathetic nerves is to cause a dilatation of the small arteries and arterioles, but after section of the vasoconstrictors, a state of more or less contraction will still exist, which can be reduced still further by stimulation of the antidromic nerves. According to Bayliss, this moderate tone left by section of the constrictors increases in a few days and becomes nearly equal to the original tone in some weeks. In clinical experience, Royle found that removal of the vasoconstrictors leads to the immediate vasodilatation of the peripheral vessels. Adson [12] and Brown [13] have shown that the evidence of increased blood flow persisted for at least six weeks in five cases of spastic paraplegia in which lumbar neurectomy had been performed for spasticity. They also observed that the temperature of the skin increased from 2 to 7 degrees following operation. Royle has observed vasomotor changes as evidenced by increased temperature in the lower limb after as long a period as three years.

Ozena is a disease caused by an obliterating endarteritis and as such should be approached similarly to Buerger's disease.

The vasoconstrictors are more or less the continually acting principle of the nerve supply and are dependent on the sympathetic nervous system. These sympathetic nerve supplies are derived from the thoracolumbar outflow and reach the nose by way of the superior cervical sympathetic and from there by way of the carotid plexus and the deep petrosal nerve to the nasal ganglion. It is, therefore, evident that to relieve vasoconstriction this pathway must be blocked, and one can do this at the nasal ganglion. Here there are both the vasoconstrictors and the vasodilators.

It is interesting to note the effect of ramisection on healing in the laboratory animal as described by Royle. Immediately after the operation of ramisection, the wound is filled with serum, and healing is not so rapid as on the side on which operation has not been performed. In a few days, however, the picture is altered, with the loss of the acute

11. Bayliss, W. M.: The Vasomotor System, New York, Longmans, Green & Company, 1923.

12. Adson, A. W.: Results of Sympathectomy in Treatment of Raynaud's and Buerger's Disease, Proc. Inter-State Post-Grad. M. Assemb., North America **3**:386, 1928.

13. Brown, Langdon: The Sympathetic Nervous System in Disease, London, Henry Frowde, 1923.

vasomotor changes. The wound on the side from which the sympathetic nerves have been removed then heals a little more rapidly than that on the normal side.

Unfortunately, in blocking the sympathetic nerve at the nasal ganglion the parasympathetic with its vasodilator fibers is also blocked. This, however, leaves the vessels of the mucosa with a more relaxed tone than that existing with the overaction of the vasoconstrictors, and explains the relative improvement in the atrophied membrane.

The benefit of blocking the sympathetic nerve by a periarterial injection of alcohol has been demonstrated by Brüning and Forster,[14] even in senile gangrene, in which they have observed relaxation of the constricted vessels.

Atrophic rhinitis must be treated in a nonspecific manner such as is commonly used in chronic infections. This can be accomplished by protein therapy, injections of manganese nucleinate, mechanical cleansing, ultraviolet light therapy and climatic changes.

CONCLUSIONS

1. Atrophic rhinitis and ozena are two separate and distinct diseases.

2. Ozena is pathologically an obliterating endarteritis of the nasal mucosa.

3. Atrophic rhinitis is the result of a chronic inflammatory disease characterized by round cell infiltration, probably secondary to severe rhinitis.

4. Ozena can be improved by blocking of the vasoconstrictor fibers at the nasal ganglion.

5. Atrophic rhinitis must be treated along nonspecific lines, such as are used in chronic infections.

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14. Brüning, F., and Forster, E.: Zentralbl. f. Chir. **49**:913, 1922.

AN EXOSTOSIS CAUSING PRESSURE EROSION AND ANKYLOSIS OF THE STAPES*

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The accompanying series of photographs presents more graphically than words can describe a certain anatomic anomaly found in our collection of material. The first photograph shows the stapes in

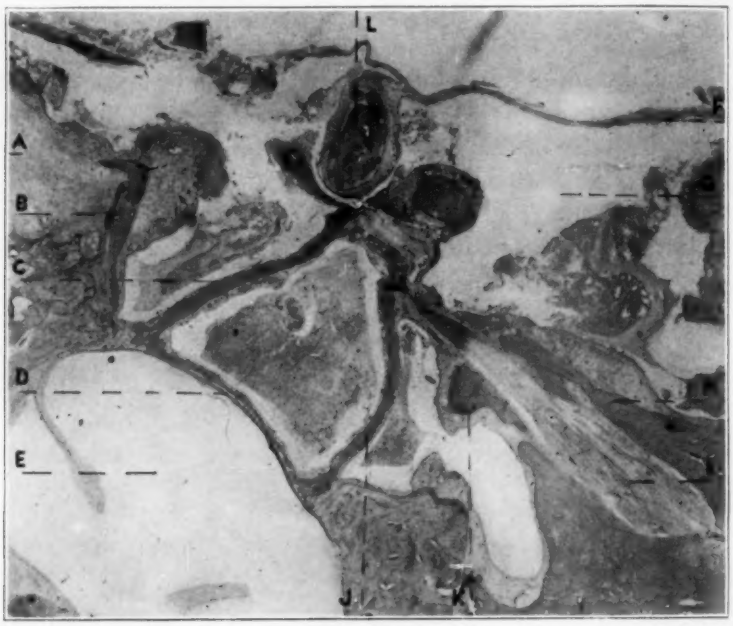

Fig. 1.—*A* indicates the tensor tympani muscle; *B*, the processus cochleariformis; *C*, the anterior crus of the stapes; *D*, the footplate of the stapes; *E*, the vestibule; *F*, the membrana tympani; *G*, the middle ear cavity; *H*, the pyramid; *I*, the stapedius muscle; *J*, the posterior crus of the stapes; *K*, the exostosis; *L*, the displaced handle of the malleus.

horizontal section with the stapedius muscle issuing from the pyramidal eminence and attaching to the head of the stapes. On the inferior border of the pyramid may be noted a slight exostosis. The second photograph illustrates this exostosis in longer section and pointing

* Submitted for publication, July 17, 1931.

* From the Department of Otolaryngology, Washington University School of Medicine.

Fig. 2.—*A* indicates the tensor tympani muscle; *B*, the processus cochleariformis; *C*, the cochlea; *D*, the anterior crus of the stapes; *E*, the footplate of the stapes; *F*, the pyramid; *G*, the stapedius muscle; *H*, the exostosis; *I*, the displaced handle of the malleus.

Fig. 3.—*A* indicates the tensor tympani muscle; *B*, the processus cochleariformis; *C*, the footplate of the stapes; *D*, the membrana tympani; *E*, pus in the middle ear cavity; *F*, the posterior crus of the stapes; *G*, the stapedius muscle; *H*, the exostosis, beginning pressure erosion.

toward the posterior crus of the stapes. The third photograph depicts its abutment against this crus and shows evidence of very early pressure erosion. The fourth photograph shows the bony projection to have extended even to the labyrinthine wall just posterior to the oval window and there to have fused with that bone. Such a series of events certainly would suggest later ankylosis of the stapes or at any rate alteration in the function of the stapes. The bony bar is of apparently normal bone.

Fig. 4.—*A* indicates the tensor tympani muscle; *b*, the cochlea; *C*, the exostosis; *D*, the stapedius muscle; *E*, the stapedial joint.

The condition occurred in the case of a 7 months old Negro infant, whose death was due to influenzal meningitis. It was unilateral. The only other significant point in the history was the diagnosis of rickets.

It is well known that in certain lower forms, as, for example, the guinea-pig, the stapes "rides" on a bony bar, but the points of origin and insertion of the bar seen in this case make it incomparable with such a phylogenetic history. Thus far descriptions of no similar anomalies have been found in the literature.

PATHOLOGIC LESIONS OF THE POSTERIOR TURBINATE TIPS

AN IMPROVED TECHNIC FOR THEIR REMOVAL *

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SAN FRANCISCO

There are three turbinate bones in each nasal fossa, with an anomalous fourth one present at times. They serve to keep the nasal passages moist and to act as a protective barrier against foreign bodies and other minute particles. Physiologically, they are closely related to the circulatory and neurogenic systems. Because of this, they are subject to a wide range of anatomic changes. In addition, the inferior and middle turbinates have a mechanical function. Anatomically, they are shelves suspended from the lateral nasal wall. In this way they serve as modified drain gutters conveying secretions in the proper direction. This mechanical directing influence is of paramount importance in relation to the secretions of the paranasal sinuses, whether these secretions be physiologic or pathologic.

A study of the nasal wall of a wet or dry anatomic specimen demonstrates readily the turbinate shelves, their influence on the directing of secretions and their relation to the ostia of the paranasal sinuses (fig. 1).

The normal ostium of the anterior sinus cavities, the frontal, anterior ethmoid and maxillary, is in the space known as the middle meatus between the middle and inferior turbinate bodies (figs. 1 to 7). The posterior sinuses, the posterior ethmoid and the sphenoid, open above the middle turbinate (figs. 1 to 7). These anatomic facts, though academic, are of importance in a study of the clinical symptoms and on examination. Should both breathing spaces be partially or wholly obstructed, owing to disease conditions in one posterior tip with other changes in the anterior nares of the opposite side, the effect on free breathing can readily be appreciated.

The characteristic complaint made by patients with a unilateral or bilateral obstruction due to a diseased condition of one or both of the

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* Submitted for publication, July 6, 1931.

* Dr. Edward C. Sewall and his associates of the Department of Oto-Rhino-Laryngology, as well as the Department of Surgical Pathology of the Stanford Medical School, furnished the anatomic material used in the preparation of this article.

posterior inferior turbinate tips is difficulty in breathing which develops for a few minutes after retiring. Such patients almost invariably show pathologic changes in the posterior ends of the turbinates. A very great proportion of such changes are in the inferior turbinate (fig. 2). This can be explained on the basis that the soft tissue of the posterior inferior tip is thicker and more redundant in the normal nose than that of the middle turbinate. It is also in contact with the secretions of all the sinuses, while that of the middle turbinate comes in contact with the secretion of the posterior group only.

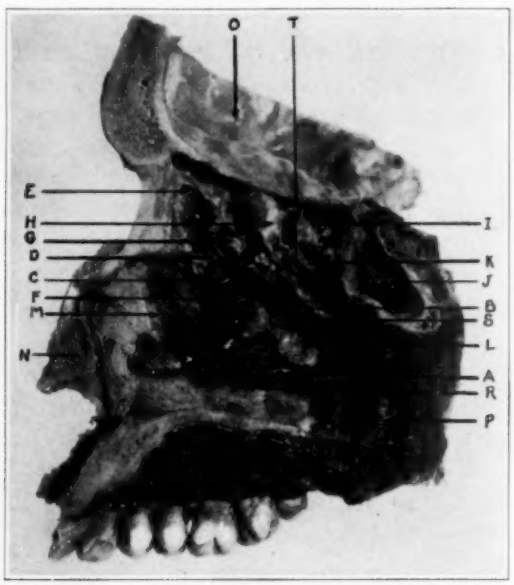

Fig. 1.—Dissection of a sagittal section through the nose. The photograph shows the right lateral nasal wall. *A*, a normal inferior turbinate; *B*, the posterior one half of the middle turbinate; *C*, a prominent uncinate process; *D*, the hiatus semilunaris extending upward to the infundibulum at *E* and backward to the normal ostium of the maxillary sinus at *F*. *G*, the bulla ethmoidalis uncapped; *H*, the anterior ethmoid cells; *I*, the posterior ethmoid cells; *J*, the sphenoid sinus; *K*, the superior turbinate body; *L*, a branch from the sphenopalatine artery to the inferior turbinate; *M*, the atrium; *N*, the vestibule; *O*, the anterior cerebral fossa; *P*, the eustachian orifice with tuberius, and *R*, *S* and *T*, the inferior, middle and superior meatuses, respectively.

My clinical experience has made me appreciate the distress of which these patients complain and also the difficulty in relieving them for more than a few moments by palliative measures. Textbooks are replete with descriptions of surgical methods of treatment. It has been my experience and that of my confrères, both in this country and abroad, that the

Fig. 2.—Photograph of specimen demonstrating the appearance of the pathologic process in the posterior, inferior and middle turbinate tips.

Fig. 3.—Photograph of specimen demonstrating the method of applying cocaine packs to anesthetize the posterior inferior turbinate tip.

obstructing tissue is seldom removed, largely owing to the use of local anesthesia. Results are better under general anesthesia. I believe the difficulties may be overcome and local anesthesia still be used.

The customary method at present is the application of cocaine with or without epinephrine (fig. 3), followed by an attempt to snare off the pathologic tissue. This is usually a failure in my hands. And why? In my opinion, owing to the constrictive properties of the pathologic lesions of the posterior turbinate tips. If secretions, demonstrated either by anterior or by posterior rhinoscopy, are located in the middle meatus, one can be relatively sure that their source is the anterior group of sinuses; if in the superior meatus, the posterior group.

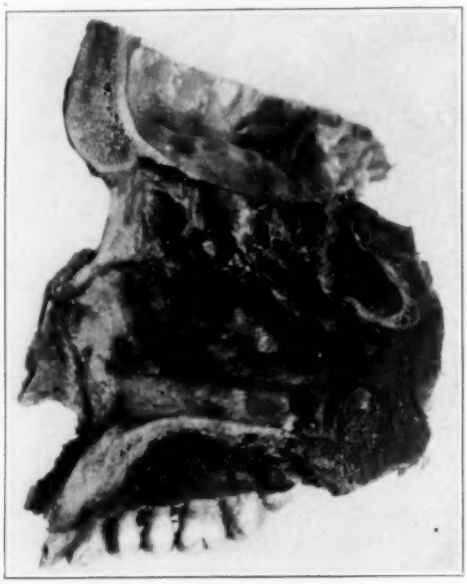

Fig. 4.—Photograph of the right lateral nasal wall demonstrating the contraction of the pathologic posterior inferior turbinate tip after removal of the cocaine packs.

Excessive secretion, abnormal in character, long in contact with any tissue causes irritation and inflammation, with subsequent pathologic changes. Neurogenic influences, as yet unproved, probably are important in causing pathologic changes as well. Nature has wisely fortified the paranasal cavities so that they endeavor at all times to remove their secretion either by independent drainage or by ciliary action. This makes for continual irritation of the turbinates, with resulting changes in the mucosa and connective tissue that are manifested clinically and are readily seen in the nasal fossa.

Fig. 5.—Photograph demonstrating the inability of the nasal snare to engage the posterior inferior turbinate tip, owing to contraction of tissue.

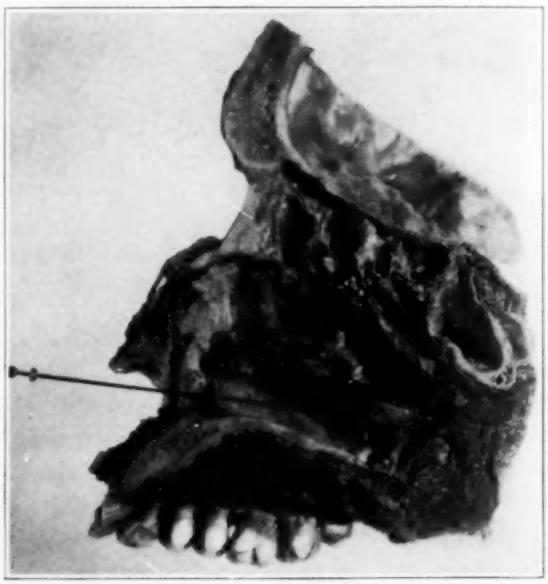

Fig. 6.—Photograph demonstrating injection of fluid, either physiologic solution of sodium chloride or procaine hydrochloride, into posterior inferior turbinate tip. It demonstrates the posterior tip enlarged.

Since in this paper I shall deal strictly with the posterior turbinate tips, the pathologic changes occurring in that particular structure only will be considered. The posterior ends of both the inferior and the middle turbinates are histologically soft tissue, mucous membrane, submucous and connective tissue adherent to the posterior bony tip. This tissue is subject to hyperplastic, polypoid and edematous changes (fig. 2). Such pathologic changes are so frequent that scarcely a week passes in which a rhinologist cannot demonstrate them in at least one patient. It is true that many of these patients do not complain of clinical symptoms. Many of them do. At times there are very distressing

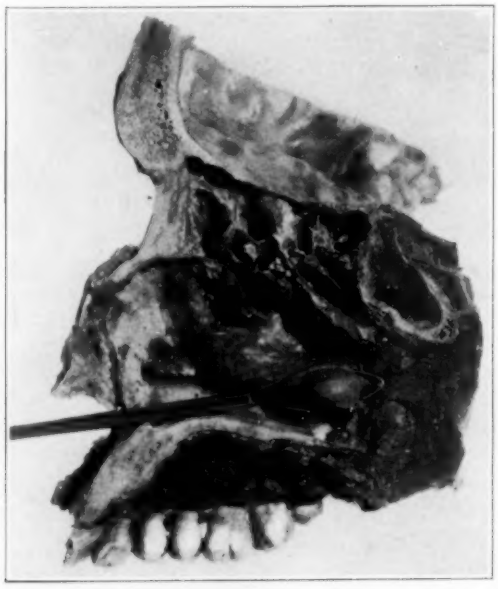

Fig. 7.—Photograph demonstrating the ease with which the snare engages the posterior inferior turbinate tip after the injection of fluid.

symptoms, not only respiratory but of a general physical and psychic nature as well.

As nature has endowed human beings with two nasal passages for breathing, one compensating for any type of obstruction in the other, symptoms are not always proportionate to the pathologic lesions seen after the use of both cocaine and epinephrine; the tissue is constricted (fig. 4) and cannot, therefore, be engaged in the snare (fig. 5). When no anesthetic is applied and the patient is willing to tolerate the pain, one seldom removes more than a very small part of the tissue. Even in pronounced conditions, it is difficult to obtain a proper grasp so that a sufficient amount of tissue can be removed.

TECHNIC

The technic that I now use and find satisfactory is as follows:

After a complete history has been taken and an otorhinolaryngologic examination has been made, cotton packs saturated with a 10 per cent solution of cocaine to which has been added 6 minims (0.36 cc.) of epinephrine hydrochloride 1:1,000 to the ounce of cocaine solution, are placed above and below the posterior third of the turbinate (fig. 3). They are allowed to remain for fifteen minutes. Meantime, topical application of a 10 per cent solution of cocaine has been made to the nasopharynx, with the purpose of anesthetizing the extreme posterior surface. After removal of the cocaine packs, a 10 cm. 15 to 20 gage needle is inserted into the anesthetized shrunken posterior tip, carrying the needle along the septal edge of the turbinate to facilitate insertion. To the needle is attached a 5 cc. Luer syringe containing 1 per cent procaine hydrochloride solution. This is injected into the soft tissue, as deeply as possible into the tip without getting into the bone. The injection of 2 cc. of solution balloons the posterior end (fig. 6). An ordinary nasal snare is used to engage the ballooned tissue, and with gradual constriction the tissue is removed (fig. 7). When possible, a small grasping forceps is used to extract the tissue by way of the nose. At times this is not practicable; then the tissue drops into the mouth and is ejected by the patient.

CONCLUSIONS

1. Pathologic changes in the posterior turbinate tip constitute a definite clinical entity.

2. They cause distressing symptoms at times.

3. The posterior tip of the inferior turbinate is usually the one involved.

4. The important diagnostic symptom of disturbed breathing in one or in both nostrils a few minutes after retiring is almost pathognomonic of a pathologic lesion of the posterior turbinate tip.

5. The only rational treatment is surgical removal.

6. Removal can be effected safely and efficiently by the technic described.

7. The sphenopalatine artery and its branches must always be kept in mind both in the injection of procaine hydrochloride solution and in the use of the snare.

8. Other nasal and paranasal pathologic conditions must be remedied to insure a permanent result.

450 Sutter Street.

ATELECTASIS FOLLOWING ASPIRATION OF PECANS*

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Because of the difficulties of making an exact and correct diagnosis of inflammation of the lungs, and because of the lack of importance attached by the laity to an exact history of events preceding any illness, pulmonary collapse and atelectasis are frequently overlooked by attend-

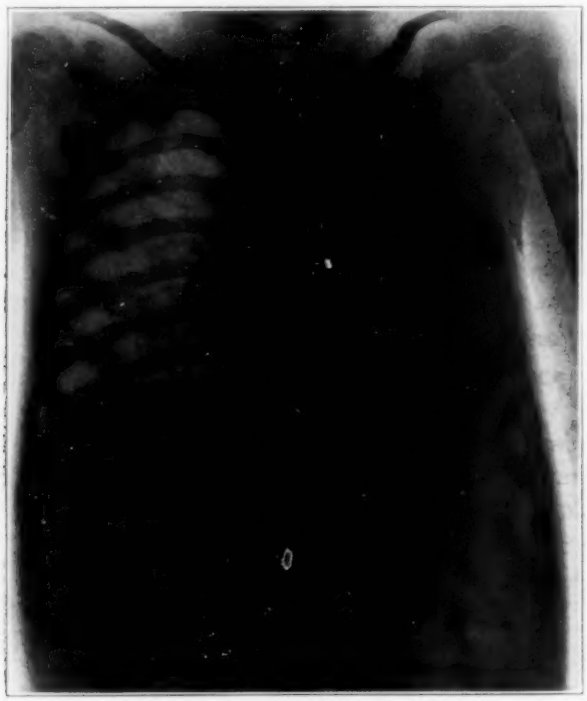

Fig. 1.—Roentgenogram taken on March 15, two days previous to bronchoscopic examination.

ing physicians. Jackson repeatedly directs attention to the importance of an exact history, and in obscure conditions to roentgen study of the lungs. I wish to report, with roentgen findings, a case to illustrate these facts.

REPORT OF A CASE

A boy, aged 4 years and 7 months, was suddenly stricken ill on Dec. 29, 1930, the diagnosis of the family physician being pneumonia. The condition gradually

* Submitted for publication, July 23, 1931.

improved, but he had a so-called relapse and finally a third attack. A roentgenogram was made on March 15, 1931, and atelectasis of the left lung was found. On March 16, I saw the patient, at which time a history of choking while eating pecans on Dec. 27, 1930, was obtained from the boy's mother.

On March 17, a 5 mm. bronchoscope was introduced. The lumen of the left bronchus was so narrowed that the tube would not pass very far. The bronchus was filled with mucopus; therefore, an aspirating cannula was passed and about 2 ounces of mucopus recovered. The lumen of the bronchus was found to be deep red due to inflammation, and, in consequence, was much narrowed.

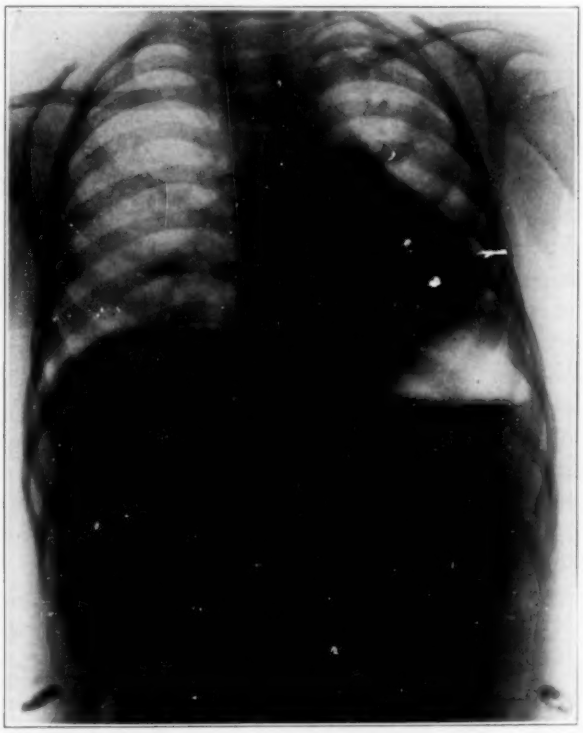

Fig. 2.—Roentgenogram taken on April 14.

Following this aspiration the boy was much improved, his cough ceased, his temperature returned to normal, his appetite improved, and he wanted to play. Six days later a return of symptoms occurred, and on the following day aspiration was again done. Four aspirations were performed at about weekly intervals. At no time were any pieces of the nuts recovered. The nuts probably caused the injury and were coughed up shortly after the boy aspirated them.

The accompanying roentgenograms illustrate the progress of the case.

In conclusion, I would urge that more careful examination be made in all cases of inflammation of the lungs, that a roentgen study be made, and finally, if indicated, that endoscopic examination and study be done.

THE MUCOSA OF THE MAXILLARY SINUS OF THE RABBIT

THE EFFECT OF ACIDOSIS AND ALKALOSIS ON THE CHANGES IN CILIATED EPITHELIUM AND EOSINOPHILIC INFILTRATION PRODUCED BY CALCIUM PRECIPITATING SUBSTANCES *

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AND
P. R. NEMOURS, M.D.
ST. LOUIS

Calcium is present in all animal cells and is necessary for normal physiologic processes. It aids in maintaining not only a normal osmotic pressure, but, to a greater extent, the proper permeability of the plasma membrane and the proper colloidal state of the cytoplasm. The action of single salts is to destroy the semipermeability of the plasma membrane. The calcium ion decreases permeability, while sodium and potassium ions increase it. This was accurately shown by Osterhout [1] and other investigators by measuring the electrical resistance of tissues placed in pure solutions of the chlorides of calcium, potassium and sodium. An increase in electric resistance indicative of a decrease in permeability was brought about by calcium; a decrease in resistance or an increased permeability occurred in the presence of sodium and potassium. Changes in the physical properties of the cytoplasm due to the influence of individual ions have been recently reported by Heilbrunn and Dougherty.[2] They showed that calcium decreased the viscosity of the protoplasm 42 per cent; sodium produced an average increase in viscosity of 40 per cent, and potassium increased the protoplasmic viscosity 23 per cent.

It is of interest in this connection to mention the effect of electrolytes on the intercellular matrix. Gray [3] has shown that the intercellular cement substance of the ciliated epithelium of the clam, Mytilus edulis, is a protein of the mucoid type, the stability of which depends on the com-

* Submitted for publication, July 22, 1931.

* From the Department of Oto-Laryngology, Oscar Johnson Institute, Washington University.

1. Osterhout, W. J.: Injury, Recovery and Death in Relation to Conductivity and Permeability, Philadelphia, J. B. Lippincott Company, 1922.

2. Heilbrunn, L. V., and Dougherty, K.: The Action of Sodium, Potassium and Calcium Ions on the Protoplasmic Viscosity of Amoeba Dubia, Anat. Rec. **47**:295, 1930.

3. Gray, J.: The Properties of an Intercellular Matrix and Its Relation to Electrolytes, Brit. J. Exper. Biol. **3**:167, 1926.

bination of this protein with calcium. In the absence of calcium or in the presence of pure sodium chloride, a soluble protein salt is formed which results in the separation of individual epithelial cells from their neighbors. Desquamation of epithelium does not occur in physiologic balanced solutions in which sodium, potassium, magnesium and calcium ions are present in definite proportions, and in which the actions of individual ions are neutralized.

Calcium is essential for protoplasmic movement. Pantin,[4] working with marine amebas, showed that of the four chief cations of sea water, calcium alone is essential for movement. In the absence of calcium, movement stopped, and definite changes in permeability and in viscosity of the cytoplasm occurred. In the fresh water amebas, Pollack [5] clearly demonstrated the necessity of calcium for ameboid movement. He injected an aqueous solution of sodium alizarin sulphonate into amebas. Granules of insoluble red calcium alizarinate were immediately formed and could be seen scattered diffusely throughout the cytoplasm. With the precipitation of calcium in the cell, ameboid movement stopped. In a similar manner, movement of cilia is dependent on the presence of ionic calcium. Lillie [6] and Gray [7] showed that the movement of cilia of the ciliated epithelium of the gills of the clam, Mytilus edulis, stopped when the anions, citrate, oxalate, tartrate or sulphate, were added to the mediums. Gray demonstrated that the ciliated epithelium of Mytilus is relatively indifferent to the action of anions. He attributed this to the reaction of cell colloids, which are definitely on the alkaline side of their iso-electric point and therefore react with cations. However, the anions that interfere with the equilibrium of the cations affect ciliary movement. The anions tartrates and citrates combine with calcium and magnesium, forming unionizable compounds. With a reduction in calcium ions ciliary movement stops.

Earlier work by one of us (Dr. Wenner,[8] 1931) showed that the movement of cilia of excised strips of epithelium from the maxillary sinus of rats and rabbits stopped thirty seconds after the application of 0.3 per cent sodium alizarin sulphonate and four minutes after the appli-

4. Pantin, C. F. A.: On the Physiology of Amoeboid Movement: III. The Action of Calcium, Brit. J. Exper. Biol. **3**:275, 1926.

5. Pollack, H.: Micrurgical Studies in Cell Physiology, J. Gen. Physiol. **11**: 539, 1928.

6. Lillie, R. S.: The Relation of Ions to Contractile Processes: I. The Action of Salt Solutions on the Ciliated Epithelium of Mytilus Edulis, Am. J. Physiol. **17**:89, 1906.

7. Gray, J.: The Mechanism of Ciliary Movement: II. The Effect of Ions on the Cell Membrane, Proc. Roy Soc., London, s.B, **93**:104, 1921-1922.

8. Wenner, W. F.: The Effect of Calcium Precipitating Substances on the Ciliated Epithelium of the Maxillary Sinus, J. Lab. & Clin. Med. **16**:341, 1931.

cation of 1 per cent potassium oxalate. In the former case recovery of normal movement occurred in three minutes, and in the latter recovery took place in five minutes. This recovery of normal movement takes place when the epithelium treated with a calcium precipitant is returned to physiologic solution of sodium chloride, and is evidently dependent on a reestablishment of an equilibrium between free calcium ions and the reserve supply of unionized calcium in the cells. As shown by other investigators in invertebrate tissue, there is no return to normal movement until calcium becomes available to the protoplasm.

Irrigating the maxillary sinus with calcium precipitants produces definite histologic changes. Wenner showed that aqueous solutions of alizarin and sodium citrate injected into the maxillary sinus of rats and rabbits five times at forty-eight hour intervals resulted in a disappearance of cilia from the columnar epithelium and a marked infiltration of eosinophilic leukocytes into the basement membrane. Rats showed chronic sinusitis three months after the last injection.

This eosinophilic infiltration was not associated with a blood eosinophilia. Differential counts made on a few experimental rabbits did not show any deviation from the normal. The percentage of eosinophils varied from 0.5 to 3 per cent and agreed with the figures presented by Pearce and Casey [9] for the blood cells of normal rabbits.

Leicher [10] based the allergic origin of vasomotor rhinitis and nonsuppurative polypoid nasal inflammation, among other things, on an increased number of eosinophils in the blood, the presence of eosinophils in the nasal discharge and an increased potassium-calcium ratio of the blood. Of twenty-four cases of vasomotor rhinitis, seventeen showed an increased potassium-calcium ratio, and of twenty-eight cases of nonsuppurative polypoid type, eighteen showed an elevation of the potassium-calcium ratio. Disturbances in the potassium-calcium ratio in bronchial asthma have been reported by other investigators, but the results are conflicting and the evidence is inconclusive. The relation between vagotonia and eosinophilia will be discussed later.

Beckman [11] (1930) believed that alkalosis or "potential alkalosis," which he defined as the tendency of the individual to store too much reserve alkali, is an etiologic factor in asthma. His view is supported by the low incidence of asthma among diabetic persons and the relief from allergic manifestations in acute infectious disease and in other conditions that produce acidosis. He advocated the use of nitrohydro-

9. Pearce, L., and Casey, A. E.: Studies in the Blood Cytology of the Rabbit: I. Blood Counts of Normal Rabbits, J. Exper. Med. **51**:83, 1930.

10. Leicher: Ueber allergische Rhinitis (ausschliesslich des Heuschnupfens), Ztschr. f. Hals-, Nasen- u. Ohrenh. **20**:238, 1928.

11. Beckman, H.: Allergy and the Acid-Base Balance, J. A. M. A. **95**:1582 (Nov. 22) 1930.

chloric acid, hydrochloric acid and acid-producing salts in the treatment for the allergic maladies, and reported that acid therapy is as effective as desensitization.

At a hydrogen ion concentration equivalent to that of the cytoplasm of the cell, calcium salts are only slightly soluble. In the plasma, about 60 per cent of the total calcium is ionized. Both ionized or diffusible calcium and soluble calcium are present in the form of calcium bicarbonate, the solubility of which depends on the p_H of the plasma. The calcium ion concentration of the plasma, according to Kugelmass and Shohl [12] (1924), is controlled by the concentration of other ions, $Ca^{++} = \sqrt{\frac{(7.6 \times 10^{-5})\ (H^+)}{(HCO_3^-)\ .\ (HPO_4^{=})}}$. Any change in the numerator or denominator will greatly affect the calcium ion concentration and also the level of the total calcium.

Wenner [13] and Swingle [14] and others reported a rise in serum calcium in parathyroidectomized dogs by increasing the hydrogen ion concentration of the blood. In view of these experiments, it seemed advisable to study the effect of acidosis and alkalosis on the changes in the ciliated epithelium and eosinophilia infiltration in the mucosa of the maxillary sinus produced by calcium precipitants.

EXPERIMENTAL DATA

Young healthy rabbits from 6 to 8 months of age were used as experimental animals. Old rabbits are subject to "snuffles," and because of this cannot be used for experimental work.

Blood was taken by cardiac puncture through a 20 gage needle into a Luer glass syringe containing paraffin oil and immediately delivered into a centrifuge tube containing liquid petrolatum and 1 drop of neutral 20 per cent potassium oxalate. The tube was centrifugated for about five minutes to separate the plasma.

The improved form of microquinhydrone electrode (Cullen [15]) was used to determine the p_H of the plasma. The electrode consists of the electrode proper, which is made up of glass tubing 5 mm. in diameter carrying a 24 karat gold wire 0.6 mm. in diameter and the electrode vessel, which is made from glass tubing 7 mm. in diameter, one end of which is drawn out to a capillary 0.2 mm. in outside diameter. This electrode is easily operated. The exposed gold wire was moistened with distilled water and touched to quinhydrone and then inserted into the electrode vessel. About 0.5 cc. of plasma was drawn up into the capillary. The electrode was then placed in a connecting vessel containing saturated potassium chloride

12. Kugelmass, I. N., and Shohl, A. T.: The Determination of the Equilibria Involving Calcium, Carbonate, Hydrogen Bicarbonate and Primary, Secondary and Tertiary Phosphate Ions, J. Biol. Chem. **58**:649, 1924.

13. Wenner, W. F.: The Prevention of Tetany by the Oral Administration of Ammonium Chloride, Am. J. Physiol. **81**:612, 1927.

14. Swingle, W. W.; Wenner, W. F., and Stanley, P.: The Effect of CO_2 Administration upon Parathyroid Tetany, Physiol. Zool. **1**:172, 1928.

15. Cullen, G. E.: An Improved Form of the Quinhydrone Electrode, J. Biol. Chem. **83**:535, 1929.

solution, the level of which was slightly lower than the level of the plasma in the capillary. The rest of the apparatus consisted of a saturated calomel electrode, galvanometer and student type potentiometer.

The normal p_H values of rabbit blood fall within a fairly wide range. Salle[16] made p_H determinations of normal rabbit blood by both the electrometric method, using a microhydrogen electrode, and the colorimetric method. In a series of seven rabbits, he found the normal p_H values to range from p_H 7.42 to p_H 7.59.

TABLE 1.—*Effect on p_H of the Blood of a Rabbit of the Injection of Sodium Bicarbonate*

	Number of Animal and Date	Amount of Sodium Bicarbonate Injected Intravenously, Gm.	p_H of Blood Before Injection at Room Temperature	p_H of Blood 10 Minutes After Injection at Room Temperature	Solution Used for Sinus Irrigation	Comment
Rabbit No. 14	Jan. 7	2	7.66, arterial blood	7.83, arterial blood	0.3 per cent alizarin	Sinus mucosa showed absence of cilia; marked infiltration of eosinophils in epithelial layer and in basement membrane
	Jan. 9	2	7.42, venous blood	7.63, arterial blood	0.3 per cent alizarin	
	Jan. 11	2	7.56, arterial blood	7.69, arterial blood	0.3 per cent alizarin	
	Jan. 13	2	7.46, venous blood	7.54, venous blood	0.3 per cent alizarin	
	Jan. 15	2	7.65, arterial blood	7.81, arterial blood	0.3 per cent alizarin	

TABLE 2.—*Effect on the p_H of the Blood of a Rabbit of the Injection of Ammonium Chloride*

	Number of Animal and Date	Amount of Ammonium Chloride Solution Injected Intravenously, Cc.	p_H of Blood Before Injection at Room Temperature	p_H of Blood 30 Minutes After Injection at Room Temperature	Solution Used for Sinus Irrigation	Comment
Rabbit No. 20	Jan. 26	20	7.62	7.00*	0.3 per cent alizarin	Sinus mucosa showed no change
	Jan. 28	15	7.60	7.64	0.3 per cent alizarin	
	Jan. 30	17	7.63	7.37	0.3 per cent alizarin	
	Feb. 1	25	7.64	7.54	0.3 per cent alizarin	
	Feb. 3	20	7.49	7.37	0.3 per cent alizarin	

*Convulsions developed in the animal immediately after injection was completed. Increased lactic acid and carbon dioxide produced by the convulsions probably account for this low p_H.

The p_H of the blood of rabbits was increased or decreased by intravenous injections of sodium bicarbonate or ammonium chloride. Two grams of sodium bicarbonate given intravenously in 5 per cent solution brought about an increase of about 0.15 p_H in ten minutes. A decrease in p_H is difficult to produce in rabbits. However, we were successful in producing a fall in p_H by injecting intravenously from 15 to 30 cc. of 0.7 per cent ammonium chloride in 0.7 per cent sodium chloride. This solution does not produce laking of the red blood cells of the rabbit. The drop in p_H is dependent on the amount of solution introduced and the time required for injection. If the solution is rapidly injected, muscle spasms and con-

16. Salle, A. J.: A Micro Electrode and Vessel for the Determination of the Hydrogen Ion of Blood Media, Whole Blood, and Other Biological Fluids, J. Biol. Chem. **83**:765, 1929.

vulsions, with a great drop in p_H, occur, while if it is very slowly injected only slight changes in the reaction of the blood result. In these experiments ten minutes were allowed for injection. Thirty minutes after injection was stopped, the p_H of the blood was again determined.

Six rabbits received intravenously 2 Gm. of sodium bicarbonate in a 5 per cent solution; this was followed in ten minutes by maxillary sinus irrigations with 0.3 per cent aqueous solution of sodium alizarin sulphonate. Two grams of sodium bicarbonate was injected intravenously into these rabbits, along with irrigations of the maxillary sinus with 1.5 per cent sodium citrate. Five rabbits received intravenous injections of from 5 to 30 cc. of 0.7 per cent ammonium chloride solution, followed in thirty minutes by irrigations of the maxillary sinus with 0.3 per cent alizarin, and the sinuses of three rabbits receiving the same amount of ammonium

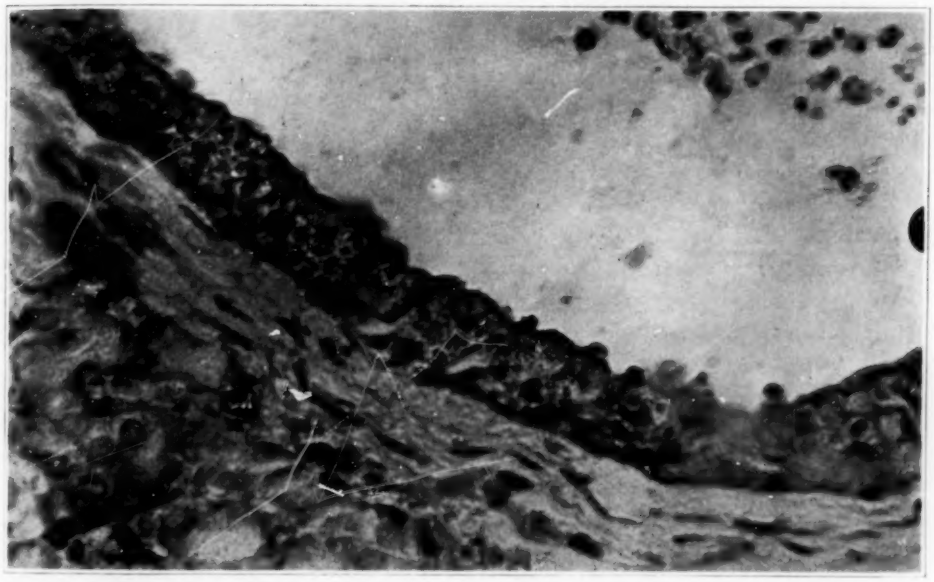

Fig. 1 (rabbit 14).—Twenty-four hours after the last intravenous injection of sodium bicarbonate and maxillary sinus irrigation of 0.3 per cent alizarin. The sinus mucosa shows a marked infiltration of eosinophils in the epithelial layer and in the lumen. A few eosinophils are present in the basement membrane. Cilia are absent.

chloride were irrigated with 1.5 per cent sodium citrate. All of these were treated five times at forty-eight hour intervals. In like manner, the sinuses of a series of animals were irrigated with Ringer-Locke's solution, 0.85 per cent of sodium chloride, 1 per cent of potassium chloride, 1 per cent of calcium and distilled water, under conditions of alkalosis or acidosis. Control rabbits were given only intravenous injections of ammonium chloride or sodium bicarbonate.

Both experimental and control rabbits were maintained on the same diet, which consisted of alfalfa, hay, oats, lettuce, cabbage and carrots. Twenty-four hours after the fifth and last treatment, the experimental rabbits were killed. The mucous membrane from the lateral and medial wall of the maxillary sinus was removed

and fixed in a diluted solution of formaldehyde, U. S. P. (1:10). Paraffin sections 4 microns in thickness were prepared and stained with hematoxylin-eosin and with Giemsa stains.

RESULTS

The sinus mucosa of the rabbits that had received sodium bicarbonate along with irrigations of the sinus with the calcium-combining substances, alizarin and sodium citrate, showed striking changes. Cilia were absent from the columnar epithelium. Eosinophilic leukocytes were present in great numbers between the epithelial cells and in the basement membrane. There was no edema. The number of eosinophils was greater than in the cases previously reported in which calcium-combining compounds alone were used.

A decrease in the p_H of the blood prevented the disappearance of cilia and the eosinophilic infiltration in all of the animals in which irrigation was done with sodium citrate. Of the five rabbits in which the sinuses were irrigated with alizarin, three showed no changes in the mucous membrane, one showed an infiltration of neutrophils, and one showed eosinophilic infiltration and disappearance of cilia. In the last case the eosinophilic infiltration is difficult to explain. It seems probable, however, that in this case the condition of acidosis was not maintained over a sufficiently long period. As has been stated, it is difficult to produce a fall in the p_H of the blood of the rabbit, and only small amounts of ammonium chloride are tolerated by this animal.

The mucous membranes of all of the control rabbits were perfectly normal.

Irrigation of the maxillary sinuses with a balanced solution, such as Ringer-Locke's solution, immediately after the production of a change in the reaction of the blood was ineffective in producing any change in the histology of the mucous membrane.

Distilled water applied to the sinus mucosa in acidotic rabbits produced only a slight swelling of the epithelial cells, presumably owing to changes in the osmotic pressure. Alkalosis resulted in eosinophilic infiltration. In this case a change in osmotic pressure and a disturbance in ionic equilibrium in the tissue in combination with an increased alkalinity evidently were favorable factors in the production of tissue eosinophilia. With the reduction in the concentration of calcium ions in the cells, a relative increase in sodium and potassium ions occurs. It seemed logical to suppose that sodium and potassium ions no longer antagonized by calcium might be responsible for the tissue changes. However, our results with sodium and potassium irrigations were not consistent. Eosinophils appeared in the basement membrane following irrigations with both salts in the presence of increased acidity of the blood. Although these results show no specificity in the action of sodium or potassium, it must be remembered that only very small amounts of

calcium are necessary to antagonize them. In these experiments the antagonistic action of calcium was not removed.

In this connection investigators in the field of allergy have attempted to illustrate the relationship between allergic reactions and an increased potassium-calcium ratio, the effects of which resemble those of vagus

TABLE 3.—*Results of Intravenous Injection of Sodium Bicarbonate and Sinus Irrigation with Various Solutions*

Solution Used for Intravenous Injection	Solution Used for Sinus Irrigation	Number of Experiments	Comment
Sodium bicarbonate (5 per cent)	0.3 per cent sodium-alizarin sulphonate	6	Sinus mucosa of all 6 rabbits showed marked eosinophilic infiltration and absence of cilia
Sodium bicarbonate (5 per cent)	1.5 per cent sodium citrate	3	Mucosae of two ribbits showed numerous eosinophils and disappearance of cilia in places; membrane of one rabbit showed no change
Sodium bicarbonate (5 per cent)	Ringer-Locke's solution	4	Tissue normal in all cases
Sodium bicarbonate (5 per cent)	0.85 per cent sodium chloride	4	Epithelium normal in three cases; basement membrane in one case infiltrated with neutrophils
Sodium bicarbonate (5 per cent)	1 per cent potassium chloride	3	Membrane of one animal showed no change; membrane of two animals showed neutrophilic infiltration and desquamation of epithelium
Sodium bicarbonate (5 per cent)	1 per cent calcium chloride	3	Ciliated epithelium normal; eosinophils present in basement membrane in all cases
Sodium bicarbonate (5 per cent)	Distilled water	2	Ciliated epithelium slightly swollen; eosinophils evenly distributed in basement membrane
Ammonium chloride (0.7 per cent)	0.3 per cent sodium alizarin sulphonate	5	Mucosae of three rabbits were normal; mucosa of one rabbit showed infiltration of neutrophils, and membrane of another rabbit showed absence of cilia and eosinophilic infiltration
Ammonium chloride (0.7 per cent)	1.5 per cent sodium citrate	3	Membrane normal in all cases
Ammonium chloride (0.7 per cent)	Ringer-Locke's solution	3	No changes in mucous membrane
Ammonium chloride (0.7 per cent)	0.85 per cent sodium chloride	3	Ciliated epithelial cells normal; numererous eosinophils in basement membrane
Ammonium chloride (0.7 per cent)	1 per cent potassium chloride	3	Basement membrane of mucosa of two animals infiltrated with lymphocytes and eosinophils; no change in mucosa of one rabbit
Ammonium chloride (0.7 per cent)	1 per cent calcium chloride	3	Tissue normal
Ammonium chloride (0.7 per cent)	Distilled water	3	Epithelial cells slightly swollen; cilia present, no leukocytic infiltration

stimulation. Thus, Hajos and his collaborators [17] stated that faradic stimulation of the vagus for periods of from one-half to eight hours produces a rise in eosinophils in the blood of guinea-pigs. Their data, however, are far from convincing. A significant rise was produced

17. Hajos, K.; Nemeth, L., and Engedy, Z.: Ueber den Einfluss der direkten Vagusreizung auf die Eosinophilie und auf die Leberstruktur, Ztschr. f. d. ges. exper. Med. **48**:590, 1926.

in four animals; two showed a considerable decrease, and four showed no significant change. The problem of parasympathetic stimulation in relation to eosinophilia needs further investigation.

Calcium chloride irrigations under normal and acidotic conditions produced no change in the mucosa. However, with increased alkalinity, a tissue eosinophilia resulted. In this case an increase in hydroxyl ions favored the precipitation of calcium.

These experiments demonstrate quite clearly that factors that influence the concentration of the calcium ion in the tissues are in some way responsible for ciliary movement and the subsequent changes occurring

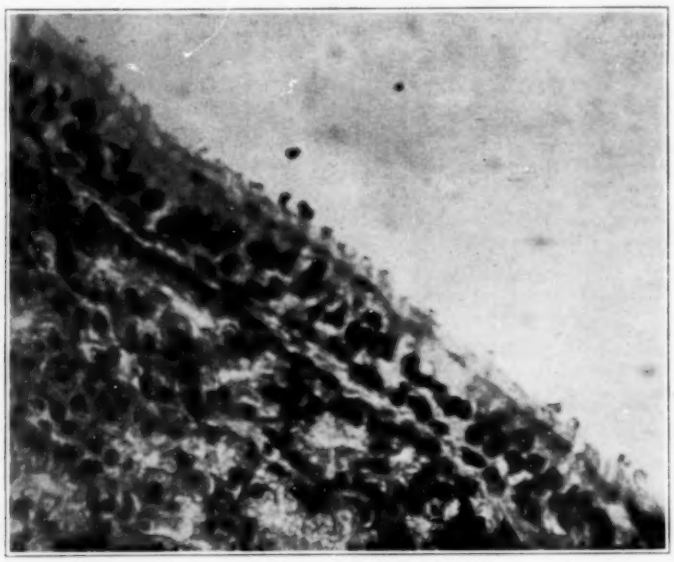

Fig. 2 (rabbit 20).—Twenty-four hours after the last intravenous injection of ammonium chloride and maxillary sinus irrigation of 0.3 per cent alizarin. Epithelium, basement membrane and submucosa are entirely normal.

in the ciliated columnar epithelium and tissue eosinophilia. An increase in alkalinity augmented the effects produced by calcium-combining substances, whereas increased acidity prevented the disappearance of cilia and eosinophilic infiltration by rendering calcium more ionizable and preventing the precipitation of calcium by alizarin and citrate.

Opie [18] made an exhaustive study of the eosinophilic leukocytes in guinea-pigs. He reported that these cells are normally present in great numbers in the walls of the trachea, in the bronchi and in the interalveolar walls outside the capillaries. In the bronchi, eosinophils

18. Opie, E. L.: The Occurrence of Cells with Eosinophilic Granulations and Their Relation to Nutrition, Am. J. M. Sc. **127**:217, 1904.

penetrate the epithelium into the lumen. The presence of these cells here is not associated with a blood eosinophilia. Our own observations on the rabbit agree with those of Opie. In the mucosa of the upper respiratory tract, however, eosinophils are not normally present. Opie further showed that eosinophilia was related to nutrition. If guinea-pigs are given plenty of food and water, an increase in the number of eosinophils occurs. Starvation, on the other hand, causes a diminution of eosinophilic cells in the bronchi. The acidosis of starvation was, no doubt, in these cases, the probable cause of these changes.

SUMMARY

1. A decrease in the p_H of the blood of rabbits was produced by intravenous injections of ammonium chloride, and alkalosis was produced by intravenous administration of sodium bicarbonate.

2. Irrigations of the sinus with solutions of the calcium-combining substances, alizarin and sodium citrate, in the presence of alkalosis produced a disappearance of cilia from the epithelium and a marked infiltration of eosinophilic leukocytes.

3. A decrease in the p_H of the blood inhibited the action of the calcium precipitants, and thus prevented the destruction of cilia and eosinophilic infiltration.

4. Sodium and potassium ions in the presence of acidosis and alkalosis produced no constant changes in the sinus mucosa.

Clinical Notes

CORRECTION OF NASAL DEPRESSIONS BY TRANSPOSITION OF THE LATERAL CARTILAGES

A New Method *

JACQUES W. MALINIAK, M.D., NEW YORK

The purpose of this communication is to describe a new procedure for the correction of limited nasal depressions by rearrangement of the nasal cartilages. A depression may involve the entire nasal frame or be confined to the bony or cartilaginous portion of the nose. The precise readjustment of all nasal components is essential for the restoration of a normal anatomic configuration.

The method of reconstruction described here applies to nasal depressions of traumatic origin. Heretofore, the usual procedure has been to correct nasal depressions by the use of a cartilage graft from a rib and in smaller defects by means of auricular and alar cartilages. The advantages of a procedure that dispenses with the use of free cartilaginous grafts are many. This applies to subcutaneous defects of the upper and middle sections of the nose.

The auricular and alar cartilages used occasionally for the correction of slight nasal depressions are biologically of a less favorable type than rib cartilage, as partial absorption is apt to occur. It is evident that an alar graft is available only in the case of an enlarged nasal tip, which requires narrowing, as no cartilage can be removed from this region without the risk of a resulting deformity.

The procuring of larger free grafts from the triangular cartilages is not without the risk of producing conspicuous lateral depressions.

Moreover, the complete immobilization of small grafts in the dorsal depression is not always easy, and postoperative failure due to displacement of the grafts is apt to follow. The resection of rib cartilage should be dispensed with in the correction of small nasal depressions because of the extensiveness of the procedure.

Transposition of the lateral cartilages is free from the disadvantages mentioned, and is the method of choice for the correction of limited nasal depressions.

SURGICAL PROCEDURE

Defects of the Middle Third of the Nose.—The lateral cartilages are loosely connected with the pyriform aperture and are in continuity with the septal cartilage. After their severance from the septum and the pyriform aperture, they can easily be transposed toward the dorsum without disrupting their connection with the underlying mucous membrane; the transposed part includes not only the cartilage but also the adjacent subcutaneous tissue, and has an adequate blood supply (figs. 1 and 2).

* Submitted for publication, Aug. 17, 1931.

The unshapely lateral cartilages, usually thickened as the result of trauma, are properly modeled, and the resistance is removed by multiple incisions. Both cartilages are brought together into the nasal depression which they are able to fill out by contact or superposition (figs. 1 and 2). The thickness of the cartilages is frequently increased by the callus, and this excess material may be advantageously used for the correction.

Transposition of the cartilages is accomplished by the endonasal route through incisions made along the inferior border of the lateral cartilages. The skin is undermined over the entire nose, and the septum separated from the columella. The depressed subcutaneous area is thus freely exposed and the suturing of the cartilages rendered easy (fig. 3).

Depression of the Upper Two Thirds of the Nose.—In cases in which the nasal bones are also depressed and the deformity extends from the glabella to the tip of

Figure 1

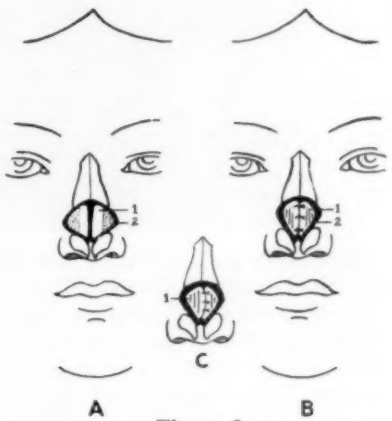

Figure 2

Fig. 1.—*A*, depression in the region of the lateral cartilages, such as often occurs after external trauma or submucous resection; the lateral cartilages are apt to be calloused and deformed. *B*, severance of the lateral cartilage from the bony structure; the resilience of the thickened cartilage is removed by vertical incisions; correction of the depression is done by approximation; *C*, affixation of the two transposed cartilages by superposition.

Fig. 2 (front view of fig. 1).—*A*, severance of the lateral cartilages at the nasal dorsum and pyriform aperture; *B*, *C*, correction of the depression by approximation or superposition of the cartilages.

the nose, the reconstruction of the bony depression is done in a way similar to that already described.

To raise the bony nasal frame, the attachment of the nasal pyramid to the facial skeleton must be severed as completely as possible, particularly at its union to the frontal bones, this being accomplished by means of angular saws introduced through small incisions in each nasal vestibule. The attachment of the frontal processes of the maxilla must be completely severed from the surrounding bony

Fig. 3.—A girl, aged 19, with a depression of the middle third of the nose (*A*) following submucous resection. *B*, front view showing deviation of the nose to the right with subluxation of the anterior part of the septum in addition to the nasal depression. *C*, same patient after transposition of the lateral cartilages. *D*, appearance after complete infracturing of the frontal processes of the maxilla and severance of the nasal bones at the dorsum, done in a stage following the transposition of the lateral cartilages. The nasal symmetry was completely restored.

Fig. 4.—A man, aged 21, showing a postoperative depression (*A*) of the lower two thirds of the nose following submucous resection. *B*, correction was done by transposition of the lateral cartilages. The unsightly bony protuberance was removed and the dorsum narrowed at the same time.

Fig. 5.—A girl, aged 20, with a saddle-back deformity of congenital origin (*A, B*). The bony depression could not be corrected by infracturing the frontal processes laterally and the nasal bones at the dorsum because of the underdeveloped structures; the presence of a double epicanthus gave the face a noticeably oriental expression. The reconstruction was done by a rib cartilage graft. The raising of the skin in the glabellar region by means of the graft corrected the epicanthus. *C, D,* appearance of the patient following operation.

Fig. 6.—A man, aged 24, with a posttraumatic nasal depression (*A*) involving the entire dorsum and tip of the nose. The correction of this deformity required the use of two independent rib cartilage grafts for the dorsum and columella. Both grafts were introduced through a vertical columellar incision. *B,* condition of patient ten days after operation.

structures; the nasal bones are infractured with straight saws at their junction, and by bringing the fractured sides together a pronounced elevation of the dorsum results. The simultaneous correction of the cartilaginous portion of the middle third of the nose is carried out as in the isolated depressions confined to this area (fig. 4).

When the nasal subcutaneous defect is due to injury sustained in childhood there is usually a disturbance in the bony growth; the nasal bones being underdeveloped, sufficient material for the reconstruction is not available and a free rib cartilage graft is required (fig. 5).

Dorsal Depressions with Flattening of the Nasal Tip.—Here the only rational method of repair consists in the use of two cartilaginous grafts, one extending from the root to the tip of the nose and the other from the anterior nasal spine to the alar arch (fig. 6).

SUMMARY

A new method of plastic repair of limited traumatic nasal depressions is here reported. It consists of the endonasal transposition of the lateral cartilages together with the subcutaneous tissue and their implantation into the dorsal depression.

By this procedure the use of free cartilaginous grafts is rendered unnecessary and the frequently deformed lateral cartilages are corrected at the same time.

Depressions of the bony nose are corrected by complete infracturing of the nasal bones at the dorsum and at their attachment to the facial skeleton; the displacement of the infractured nasal walls toward the middle line causes a pronounced elevation of the dorsum.

The repair of saddle-back deformities of congenital origin can be accomplished only by the use of a free graft.

1125 Park Avenue.

NEURITIS OF THE AUDITORY NERVE OCCURRING DURING INTRAVENOUS ARSENIC MEDICATION

Report of a Case with Recovery *

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Arsenic has been known in therapeutics since the Christian era. Its prominence was due to its dangerous lethal oxides, which were favorite vehicles in the sixteenth century for criminals in their nefarious practices.

The natural history of this drug is a most fascinating story. In the sixteenth century, arsenic formed a base for the numerous green dyes used extensively in the preparation of materials for the arts. Scheele's green, Schweinfurt's green and numerous other green dyes contained large quantities of arsenic and were readily obtainable. It was easy for any one with homicidal tendencies to obtain the dyes and thus have at his disposal large quantities of the arsenic. Paris green was a favorite with unfortunates who planned suicide.

* Submitted for publication, July 30, 1931.

In 1900, there was a widespread epidemic of arsenic poisoning in which thousands of people were affected. A commission [1] was appointed, and after a thorough investigation it was found that all the cases of poisoning had occurred among the poorer working classes who had imbibed much cheap beer. Further investigation revealed that the arsenic was contained in the sulphuric acid that was used in the preparation of the dextrose utilized in the manufacture of the cheap beers. There was no mention of neuritis of the eighth nerve in any part of Buchanan's report.

Arsenic has been used as a food preservative when, paradoxically, it has been used extensively in sprays to destroy insect pests in fruit orchards. As a result of this usage, widespread poisoning from wines has been observed in France.

Legge [2] stated that some types of wall-paper formerly have been found to contain as much as the equivalent of 60 grains (3.9 Gm.) per square foot of arsenic oxide. Preparations containing arsenic have been used to preserve furs, skins and hides, and in this way arsenic has been a source of many poisonings. Many other industrial uses of the different arsenicals have been the means of a certain number of arsenic poisonings. Although many cases of poisoning of this origin have been reported, deafness is not mentioned as a symptom.

In a most interesting book, in 1817, Marshall [3] mentioned a series of cases of acute arsenic poisoning in which there occurred, besides the usual symptoms, dimness of vision and peripheral neuritis, but no mention was made of auditory symptoms.

Dupoux,[4] in 1900, stated that occasionally the nervous system was involved during the course of arsenic medication, paralyses, ataxias and amaurosis resulting, but he did not encounter or mention deafness.

In 1912, Le Fort,[5] in careful study of untoward accidents following the use of arsenicals, mentioned numerous ocular complications, optic neuritis, retrobulbar neuritis and involvement of the eye muscles. It was his belief that when these occurred during antisyphilitic treatment, they were due to the action of the arsenic on already diseased tissues. Duane [6] stated that often in the course of arsphenamine treatment optic neuritis develops in the patient. Some have attributed this to the arsenic, calling it a toxic amblyopia, but others believe that this is not due to the toxic action of the arsenic but to the liberation of spirochetes or their toxins, owing to provocative action of an insufficient dose of arsphenamine.

At the Toronto General Hospital from 1919 to 1924 there were thirty cases of arsenic poisoning following intravenous therapy in syphilis, and definite neuritis did not accompany any of these cases.

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1. Buchanan, G. S.: Report to Local Government Board on Recent Epidemic Arsenical Poisoning Attributed to Beer, London, Eyre & Spottiswoode, 1901, p. 4.

2. Legge, T. M.: Arsenical Poisoning; in Kober, G. M., and Hanson, W. C.: Diseases of Occupation, and Vocational Hygiene, Philadelphia, P. Blakiston's Son & Co., 1916, p. 3.

3. Marshall, J.: Remarks on Arsenic, London, J. Callow, 1817.

4. Dupoux, P.: Accidents de la médication arsénicale interne, Paris, J. B. Baillière et fils, 1900.

5. Le Fort, E.: Contribution à l'étude des accidents oculaires attribués aux solutions arsénicales, Paris, H. Dider, 1912.

6. Duane, A., in Fuchs: Textbook of Ophthalmology, ed. 8, Philadelphia, J. B. Lippincott Company, p. 772.

Strathy, Smith and Hannah [7] noted peripheral neuritis in two of fifty-eight cases of delayed arsenic poisoning from intravenous medication.

Politzer [8] stated that the auditory nerve is more often affected by the action of drugs in the circulating blood than are any of the other nerves of the special senses. One need only recall the action of such medicaments as quinine, salicylic acid, chloroform and oil of chenopodium, which exercise a temporary, often a permanent, influence on the function of the auditory nerve, unilateral or bilateral. Other drugs having a paralyzing effect on the auditory nerve are lead, mercury, arsenic and phosphorus.

In his system, Osler [9] reported paralyses from arsenic of single isolated nerves, such as the recurrent laryngeal or motor nerves of the eyes or the optic nerve. Accidents of this nature seem to be more common since the introduction of intravenous methods of treatment, and have brought up the question of a local Herxheimer reaction.[10]

I might mention at this time the reports of Wodak [11] who recapitulated his experiences over a period of four years with the therapeutic use of arsenic in cases of deafness, reiterating the value of this form of treatment. He did not mention any cases in which the hearing was made worse.

PATHOLOGY

To mention the general pathologic processes that occur in arsenic poisoning is not within the scope of this paper. I am mainly concerned with the nervous system, which does not show any gross lesions. The neuritis that results from arsenic poisoning is due to the affinity of the poison for the lipoids of the myelin sheaths.

In a communication in which only the anatomic changes that might be caused by arsenic poisoning demonstrable only in fresh cadavers were considered, Hektoen [12] did not find any gross lesions of the brain or cranial nerves. In the peripheral nerves, however, well marked microscopic changes were evident.

REPORT OF A CASE

History.—A man, aged 34, a contractor, complained of suddenly becoming deaf two weeks before being seen by me. There was no family history of syphilis, deafness, tuberculosis or blood dyscrasia. The patient was married and had one child who was living and well. There was no history of miscarriages or stillbirths. Except for the fact that he smoked twenty cigarets daily, and had had psoriasis since childhood, the patient's past history was essentially negative.

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7. Strathy, G. S.; Smith, C. H. V., and Hannah, B.: Report of Fifty-Eight Cases of Delayed Arsenic Poisoning Following Administration of Six Hundred and Six Preparations, Canad. M. A. J. **10**:336, 1920.

8. Politzer, A.: Diseases of the Ear, Philadelphia, Lea & Febiger, 1926, p. 647.

9. Osler, W.: Arsenic, in Modern Medicine, Philadelphia, Lea & Febiger, 1925, vol. 2, pp. 668-675.

10. Herxheimer, K., and Martin, J.: So-Called Herxheimer Reactions, Arch. Dermat. & Syph. **13**:115 (Jan.) 1926.

11. Wodak, E.: Arsenic Treatment in Deafness, Laryngoscope **37**:894, 1927.

12. Hektoen, L.: The Pathological Anatomy of Acute Arsenical Poisoning, North Am. Pract. **3**:497 (Nov.) 1891.

Because he felt somewhat let down mentally and physically, the patient went to his family physician, who, after routine examination, advised rest and a tonic to help reinvigorate him. He was given one intramuscular injection of iron and arsenic, 5 cc. Around the site of the injection he noted tenderness, and he had so much spontaneous pain that he vigorously objected to this form of administration. He was then given a series of intravenous injections of the same preparation, twice weekly, about six or eight injections being given. Over two weeks before I saw him, he was aware that he could not hear with his right ear, and that he had peculiar sensations in this ear. He told the doctor that he could not hear very well with that ear and that prior to the injections he had had excellent hearing. The attending physician felt that this had nothing to do with the intravenous injections, and promptly gave him another one. That night the patient noted that he could not hear at all on the right side.

After a day or so the patient became exceedingly upset over his inability to hear, and called his doctor. A consultation was advised. An ear, nose and throat specialist told him that he had unilateral deafness, and advised that a Wassermann test be made of the blood. The results were negative.

Examination.—Two weeks later, the disgruntled patient arrived in my office. Routine physical examination revealed a man, apparently in excellent health, with no evidence of anemia clinically or on blood examination. There was no fever or jaundice. The pulse rate was 90; the blood pressure was 130 systolic and 95 diastolic, and the urine was normal. The pupils reacted to light and in accommodation, and the fundi were normal; there were no extra-ocular palsies, contraction of the visual fields, nystagmus, past pointing, cerebellar or vestibular signs, meningeal signs, sensory changes or pyramidal tract signs.

Examination of the ears showed that all landmarks were visible, with no retraction of the drums or evidence of any adhesive process in the middle ears. There was a small red spot on the right drum, due to trauma with a match stick. (With the use of a Segal speculum it could be seen moving with the tympanic membrane.) There was no perforation.

On June 8, two weeks after the last intravenous injection, hearing tests revealed normal hearing on the left, and on the right almost total loss of hearing with: (*a*) a very greatly diminished bone conduction; (*b*) no air conduction (the patient did not hear the tuning forks *C1, C2, C3, C4* or *C5* at all); (*c*) the Weber test lateralized to the left, and (*d*) with the noise apparatus in the left ear, ability to distinguish a loud voice close to the ear but inability to determine what was said.

The results of the examination of the nose, throat, sinuses and larynx and of the remainder of the physical examination, were essentially negative, except for the typical scaly psoriatic lesions on the elbows, navel, scrotum and ankles.

At this time, the patient was advised by me to omit all further injections, he was given a high fluid diet, and was told to avoid coming in contact with any materials containing arsenic to which, as a contractor and builder, he might be exposed (paints, metal dusts, etc.).

On June 10, two days after he was first examined by me, his hearing was unimproved; urinalysis was negative.

On July 16, over three weeks after the last intravenous injection, there was no change in the appearance of the middle ears. No abnormal signs or symptoms were evident after a complete physical examination. To my great astonishment

there was a most unusual, unlooked for return of function in the impaired ear. With the noise apparatus in the normal left ear, the patient heard a soft forced whisper. Air conduction was greater than bone conduction in the right ear and was almost normal in duration as compared with that in the uninvolved left ear. The response to the Weber test was normal; i. e., there was no lateralization to either ear. The patient heard the middle and low tones with the right and left ears equally.

The improvement in hearing was startling. There was still about 15 per cent impairment in the right ear. Subjectively at that time, the patient was still aware of a difference in the acuity of hearing of the right ear as compared with the left.

At this time, I obtained a twenty-four hour specimen of the patient's urine, and had about one third of it tested for arsenic. It was reported positive, a moderate amount of arsenic being present.

Repeated tuning fork tests at later dates have since revealed a complete return of function in the right ear. At no time was there any vestibular disturbance.

COMMENT

It is well known that arsenic is excreted slowly. After large doses, arsenic sometimes appears in the urine and feces in from twelve to twenty-four hours; however, it should be borne in mind, according to Cushny,[13] that only about 20 per cent is excreted in this way. The balance is stored in the tissues for a long time and is excreted very slowly via the excretions, hair and skin. It is likely that the effects, especially the paralyses, last long after the drug has been excreted.

When arsenic is given intravenously, it disappears very rapidly from the blood. It is rapidly taken up by the fixed tissues, forming firm union with the nucleins and nucleoproteins of the liver, kidney, walls of the stomach, intestines, muscles and nervous system tissues. Irakawa[14] recovered as much as 90 per cent of the total amount of arsenic injected intravenously. In his studies, at the end of three weeks arsenic was still being excreted. Silberman[15] experimentally injected various poisonous substances, among them arsenic, into animals, and came to the conclusion that many of the clinical phenomena and anatomic changes in arsenical intoxication are directly referable to the power of arsenic to cause a vascular dyscrasia, resulting in primary capillary thrombosis with the formation of secondary stagnation thrombi. Of course, to suppose that such was the mechanism in our case is highly theoretical and cannot be proved, but it is a possible mechanism explaining the sudden loss of function and rapid recovery.

In conclusion it may be said that whenever a patient is receiving any of the heavy metals therapeutically, especially intravenously, the hearing apparatus should be carefully watched. Should any suspicious aural symptoms supervene, it is far safer to discontinue therapy temporarily.

49 East Ninety-Sixth Street.

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13. Cushny, A. R.: Textbook of Pharmacology and Therapeutics, ed. 7, Philadelphia, Lea & Febiger, 1927.

14. Irakawa, K.: Excretion of Arsenic in Urine After Intravenous Injection of Arsphenamine, abstr., J. A. M. A. **63**:2077 (Dec. 5) 1914.

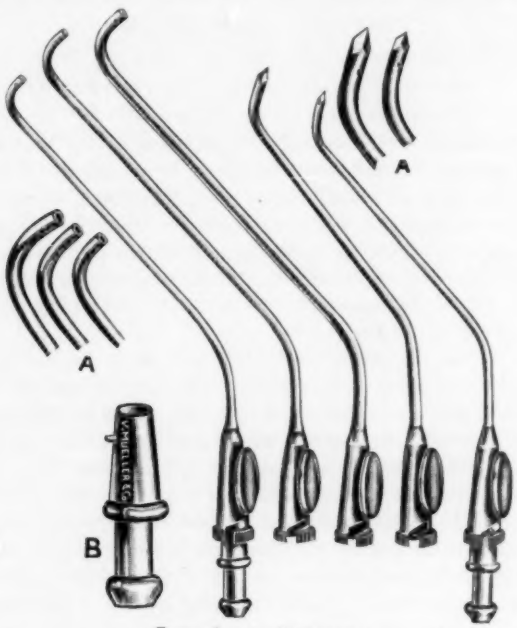
15. Silberman, O.: Ueber das Auftréten multipler intravitaler Blutgerinnungen nach acuter Intoxication durch chlorsaure Salz, Arsen, Phosphor und andere Blutgifte, Virchows Arch. f. path. Anat. **117**:288, 1889.

CANNULAS AND TROCARS FOR OPERATIONS ON THE MAXILLARY SINUS THROUGH THE MIDDLE MEATUS *

M. C. Myerson, M.D., New York

A set of three blunt cannulas and two trocars is presented for use in entering the maxillary sinus through the middle meatus.

The blunt cannulas are presented as modifications of the original Pierce cannula and are for the purpose of entering the antrum through its natural opening. The cannulas were so designed as a result of an anatomic study of the maxillary ostium and its relationships in 114 lateral nasal walls. The cannulas are so curved at



Cannulas and trocars.

their distal end that they can be readily introduced into a horizontally or obliquely placed ostium such as frequently exists in the infundibulum.

The cannulas are made in three sizes. The medium size is the one that is used most frequently. The largest of the three is used when the rhinologist has ascertained that he is dealing with an ostium of a larger size which will readily permit the larger cannula to be used. The smallest size is for infants and young children. At times this size can be used advantageously when a narrow middle meatal passage is encountered.

The trocars are suggested for use in the middle meatus when a blunt cannula cannot be passed through the natural orifice. One must bear in mind the anatomy of the middle meatus before using a piercing instrument in this region. Attention is called to the fact that puncture through the infundibulum anterior to the max-

* Submitted for publication, July 1, 1931.

* From the Department of Laryngology, Mount Sinai Hospital.

illary ostium will carry the instrument into the orbit. One must be sure of the position of the point of the trocar in the middle meatus before one forces it through the lateral wall of the nose. It is preferable to stay close to the upper surface of the inferior turbinate when using this procedure.

Puncture through the middle meatus by means of a sharp needle or trocar is not new. It was first suggested by Zuckerkandl and performed by Hartmann in 1884.

12 East Eighty-Sixth Street.

ABSCESS OF THE FRONTAL LOBE DUE TO ACUTE FRONTAL SINUSITIS *

T. Flournoy Wickliffe, M.D., Jasper, Ala.

This case presents several unusual features which seem to warrant its being recorded. The patient, a youth, aged 18, came to see me on Aug. 16, 1930, suffering from severe pain over and about the region of the left eye which was swollen shut. Examination of the nasal passages revealed spongy, hypertrophied turbinals and a purulent discharge in the middle meatus on the left side only. The shrinking of the tissues in the nose allowed the escape of a quantity of pus with considerable relief from symptoms. The necessity for an operation was recognized, but the patient would not consent.

On September 2, an intranasal operation was done to improve frontal drainage. The bone seemed to be dense as though a condition of osteosclerosis existed. Following the operation most of the swelling about the eye disappeared, and after remaining in the hospital for three or four days the boy went home. The improvement was only temporary; in a few days he was again suffering from pain, and the swelling about the eye had increased.

On September 11, with the patient under general anesthesia, an external operation was carried out on the frontal sinus together with a window resection of the nasal wall of the maxillary sinus. A discolored area the size of a dime about the middle of the posterior wall was noted at this time. The probe did not disclose any opening through this bone.

The temperature at the time of operation was 100 F., and the pulse rate 80. There was a slight rise in temperature during the next couple of days.

Temporary improvement followed the operation, then the temperature began to rise, and the patient had recurring, rather severe pains in the head, paroxysms occurring usually at night. His pulse became slow, the rate usually being in the sixties, but it dropped as low as 52. He was rational most of the time. On the development of the subnormal temperature and slow pulse, an effort was made to secure consent for an operation for the purpose of opening a frontal lobe abscess which I believed existed. Consent was not granted, however.

On November 17, when the boy came into the office, he was still very thin. The pulse was good and the left eye swollen shut; there were bulging of the forehead which fluctuated, and at either end of the eyebrow a fistula which allowed some pus to escape. Incision of the bulging area in the forehead opened into a large frontal lobe abscess which had eroded through the posterior wall of the

* Submitted for publication, July 10, 1931.

frontal sinus for the space of about the size of a half dollar. The abscess cavity was packed gently with one-half inch iodoform gauze. It took 5 yards to fill the cavity. Following this operation the patient went into a state of shock, the pulse and respiration were very rapid and weak, and death occurred during the night.

The unusual feature about the situation is the fact that, because of the unwillingness to permit prompt surgical intervention, I had the opportunity of watching the course of a frontal lobe abscess leading to a spontaneous external rupture.

SUDDEN DEATH ELEVEN HOURS AFTER TONSILLECTOMY FOLLOWING LOCAL APPLICATION OF COCAINE*

KARL MUSSER HOUSER, M.D., PHILADELPHIA

On April 22, 1931, a girl student, aged 18, was admitted to the students' ward of the University Hospital for tonsillectomy. At the age of 5, the tonsils and adenoids were removed, but, as the removal of the tonsils had been incomplete, considerable lymphoid tissue was left, filling the inferior portion of each tonsillar fossa. During the winter months, the patient always experienced several attacks of sore throat, and it was observed by both her family doctor and the student physician that these attacks were associated with considerable inflammation of the lymphoid masses mentioned. On this account, she was advised to have the tonsillar masses removed.

At 2 p. m. she was given 3 grains (0.195 Gm.) of sodium amytal, and one hour later I performed the operation under procaine anesthesia. No cocaine was used previous to the injection. The Cook carpule injection syringe was used, so that there was no possibility that cocaine was injected by mistake. In all, two carpules of a 1 per cent solution of procaine and epinephrine were used. The operation was well tolerated by the patient; at no time was she unduly nervous or apprehensive, nor did she show any tendency toward syncope. The tonsillar masses were rather fibrous and not large; they were removed with little difficulty and slight bleeding. At 3:30 p. m., the patient was returned to the students' infirmary, apparently in good condition. The temperature and pulse and respiratory rates recorded by the nurse at this time were normal. The last recorded temperature was taken six hours after operation, at which time both the pulse and the respiratory rates were normal, with a slight elevation of temperature to 99.3 F.

At 10 o'clock, a resident physician was summoned on account of slight bleeding. He found a blood clot in the right tonsillar fossa, which he removed. After this removal a sponge soaked in a 1:1,000 dilution of epinephrine chloride solution was applied, which promptly controlled the bleeding, which was very slight. At 2 a. m., eleven hours after operation, bleeding was again reported. This call was answered by a different resident physician, who also found a clot in the right tonsillar fossa. He removed it, and applied a sponge soaked in a 10 per cent solution of cocaine hydrochloride and epinephrine chloride. This sponge was allowed to remain in place probably a minute, and an application of liquor ferri subsulphatis was then made. A small bleeding point was then discovered, which was clamped with

* Submitted for publication, July 18, 1931.

* From the Department of Otolaryngology of the Hospital of the University of Pennsylvania.

a hemostat. Almost immediately a generalized convulsion occurred, and respiration either ceased or became so shallow as to be imperceptible. No radial pulse could be detected. Epinephrine chloride given subcutaneously and caffeine sodium benzoate were immediately administered with artificial respiration. Later epinephrine was injected directly into the heart and oxygen administered with cardiac massage. Death, however, occurred, in spite of all the efforts of those in attendance, and when the patient was seen by me at 2:25 a. m., there was no evidence of heart beat or respiratory movements.

I believe that this case should go on record as a warning to all against the dangers of using cocaine preparations in any concentration in surgical procedures on the throat; this point was stressed by Dr. Emil Mayer in his various reports on toxic manifestations following the use of local anesthetics. It is almost certain that the procaine was not a factor in this case, for no case of delayed procaine toxemia has ever been observed. In addition, this case strengthens the view of Dr. Mayer, who, after thorough study of all reported cases, believes that procaine rarely, if ever, causes death, but that in cases in which death has followed its administration, cocaine too, accidentally or intentionally, has been used.

Progress in Otolaryngology

A Summary of the Bibliographic Material Available in the Field of Otolaryngology in 1930-1931

LARYNGEAL TUBERCULOSIS

GEORGE B. WOOD, M.D.
PHILADELPHIA

Tesone [1] reported a case of what he believed was a primary laryngeal tuberculous lesion occurring in a woman 35 years of age. He described the condition as a papillomatous tumor situated on the posterior half of the vocal cord and involving the adjacent part of the arytenoid. The character of the lesion was determined by biopsy. The general health of this patient was good. There was no loss of weight, and no bacilli could be found in the sputum. There was no fever, and the roentgen examination of the chest gave negative results. The patient was treated by vocal rest for one year and heliotherapy, with complete disappearance of the lesion.

Another case was reported by Castellanos [2] in a girl 14 years old, and the diagnosis was also confirmed by biopsy. No evidence of tuberculosis could be found in any other organs clinically, and roentgenograms showed the lungs to be normal.

In neither of these cases was a postmortem examination performed, so that I do not believe that they should be considered as proved cases of a primary laryngeal lesion. On the other hand, the complete absence of clinical and roentgen indications in these cases is of great importance in that it shows that an absence of pulmonary signs does not exclude tuberculosis from the possibilities when a diagnosis of some doubtful laryngeal lesion is being considered.

This is well demonstrated in a case reported by Linck.[3] Here the diagnosis was made by microscopic examination after operation, though on clinical examination the growth was supposed to have been a malignant neoplasm. The diseased mass that was removed by laryngofissure was found to be a granulotuberculoma. Also, in this case, no clinical evidence of any other tuberculous lesion could be found. The patient made a good recovery.

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1. Tesone, P.: Rev. de especialid. **4**:561 (July) 1929.
2. Castellanos, A. Iglesias: Rev. méd. del Rosario **4**:287 (Oct.) 1929.
3. Linck, A.: Arch. f. Ohren-, Nasen- u. Kehlkopfh. **126**:262 (Oct.) 1930.

In making a diagnosis of laryngeal lesions it is important to bear in mind the possibility of the lesion not only being tuberculous but having implantations of some malignant growth at the same time. A case reported by Tucker [4] showed an isolated lesion in the anterior portion of the right vocal cord. This patient, a man, had advanced pulmonary tuberculosis, but because of the charac[illegible] of the lesion a biopsy was performed; histologic examinat[illegible] both tuberculosis and early cancer.

The amount of [illegible] that [illegible] om tuberculosis of the larynx while the patient is still alive is a [illegible] st inconceivable, and cases have been observed in which the whe[illegible] r wall of the larynx has sloughed away, making it almost impossible for the patient to swallow without a large part of the liquid or food entering the trachea. However, it is fairly uncommon to see a simple perforati[illegible] of the laryngeal wall, and therefore it is interesting to note [illegible] Tyson [5] of perforation through the thyroid cartilage w[illegible] of age, was abscess formation in the neck. A white man, 31 years[illegible] years. An supposed to have had laryngeal tuberculosis for about f[illegible] th dysphagia, acute pain suddenly developed in the front of the neck [illegible]ght days later, difficult breathing and aphonia, and the patient died [illegible]ced pulmonary apparently of laryngeal obstruction. At autops[illegible] right lobe of the tuberculosis was found. In the neck, b[illegible]ack [illegible]ued up nearly to the thyroid gland, there was an abscess whi[illegible]ay ulcerated, and the rest tonsillar fossa. The left vocal cord wa[illegible]ch swollen. A slitlike per- of the laryngeal mucous membran[illegible] the anterior laryngeal wall foration was found in the m[illegible] the vocal cords just below the between the anterior attach[illegible] was a sinus with thick fibrous walls thyroid notch. From thi[illegible] right thyrohyoideus and connected with running backward bene[illegible]t lobe of the thyroid gland. Histologic the abscess beneath [illegible]culosis of the left vocal cord with marked examination showed [illegible]artilage along the line of the perforation was fibrotic changes. [illegible] considerable lymphocytic infiltration down to the eroded, and the [illegible] sinus tract outside the larynx also showed fibrosis perichondrium [illegible]osis.

as well as t[illegible]y of literature Tyson believed that in most of the cases

From [illegible] the opening is anterior, either between the halves of the of perfo[illegible]age or through the thyrohyoid membrane. He found three thyroi[illegible]sterior perforation.

case[illegible]

—[illegible]ucker, Gabriel: A Case of Chronic Hoarseness (Ulcerative Laryngitis) [illegible]g Tuberculosis and Cancer in the Same Lesion, J. A. M. A. **96**:1572 [illegible] 9) 1931.

5. Tyson, M. D.: Perforation of the Larynx from Tuberculous Laryngitis, [illegible]rch. Otolaryng. **12**:297 (Sept.) 1930.

There is no doubt but that the laryngeal structures become involved in a much higher percentage of cases of pulmonary tuberculosis than was formerly supposed, but the number of cases found by Rubin [6] showed a little higher percentage than is even now generally believed. Of 526 patients who were examined laryngoscopically during life or subsequently by autopsy, approximately 1 of every 2 with pulmonary tuberculosis showed tuberculosis of the larynx at the time of death. Another interesting factor, and it was the chief objective of Rubin's study, was an apparent relationship between the laryngeal and intestinal involvement. In the first place [illegible]sis show intestinal ulcers, but that persons dying of pulmonary [illegible]mined post mortem whose pulmonary 90 per cent of the pa[illegible]ngeal tuberculosis have intestinal tuberculosis and [illegible]atomic extent and character the tuberculous processes lesion is complic[illegible]s under 30 years of age this figure is raised to [illegible]e larynx and intestines parallel each other to a considerable degree, and Rubin believes that when tuberculosis of the larynx and intestines coexist the intestines become involved relatively early in the course of the laryngeal disease. The importance of these observations lies in the fact that intestinal tuberculosis is extremely difficult to diagnose in its early stages; therefore, abdominal symptoms when present in advanced pulmonary disease are always more significant if the larynx is likewise involved. As far as treatment is concerned, the care of the laryngeal lesion, Rubin said, does not have any beneficial influence on the intestinal involvement.

Rubin's observations are not surprising when one remembers that the large majority of laryngeal involvements are due to contact inoculation of the laryngeal mucosa, and the greater the amount of bacilli-laden sputum that is coughed up from the lung, the greater is the chance of laryngeal as well as intestinal involvement. When the larynx has become involved, the sputum that gets to the orifice of the larynx is more easily swallowed than coughed out; hence, a greater amount of infected sputum reaches the intestinal tract in patients with laryngeal tuberculosis than when this complication does not exist. It has been shown experimentally by Ravenal and others that the intestinal tract can be easily inoculated by feeding with tuberculous food, and of course the greater the number of bacilli that are introduced into the intestinal tract the greater the chance of inoculation of its mucosa.

Quite a complete thesis on the subject of laryngeal tuberculosis, considering not only the etiology but also the pathology and treatment of this disease, has been published by Safranek.[7] This is a lengthy and

6. Rubin, E. H.: Am. J. M. Sc. **181**:663 (May) 1931.
7. Safranek, J.: Monatschr. f. Ohrenh. **64**:635 (June) 1930.

detailed consideration of the whole subject, and it is worth-while reading for those who desire a concise and comprehensive statement concerning the modern concepts of this disease.

Safranek's views concerning the etiology of laryngeal involvement were based on the classification of tuberculosis according to Ranke, and he divided the laryngeal involvement into three classes:

First, primary tuberculosis of the larynx is so rare as to be practically excluded, and laryngeal tuberculosis must always be looked on as a secondary manifestation.

Second, a laryngeal lesion occurring in the secondary or generalization stage of tuberculosis is due to a hematogenous infection which spreads in the larynx by way of the lymphatic vessels. About one fifth of Safranek's cases occurred in this stage of tuberculosis. In support of the possibility of this method of infecting the larynx he quoted Manassa's article on tuberculous thrombophlebitis of the lymphatics of the larynx. He does not believe in a direct lymphatic infection of the larynx from the tonsils or cervical lymph nodes as has been claimed by some authors.

Third, by far the largest group of cases are those which occur during the third stage of tuberculosis, in which there is an isolated pulmonary lesion and the laryngeal mucosa is directly inoculated by sputum filled with bacilli coughed up from the lungs.

As to the possibility of primary tuberculosis of the upper respiratory tract, lesions in the anterior part of the nasal fossae in otherwise apparently normal persons are not very uncommon. Havens [8] reported five cases of what he called primary nasal tuberculosis, observed in the Mayo clinic. These patients were all over 50 years of age. The lesions consisted of granular masses involving the septum or turbinates, and in only one instance was ulceration noted. Havens believes that radium, diathermy or the cautery are efficient means of treatment.

I have seen several cases that looked like primary nasal tuberculosis, but old healed lesions in the lungs could be detected by roentgenograms in almost all of these patients. One must remember that inoculation of the nasal mucosa is not uncommon in active pulmonary tuberculosis. These lesions sometimes closely resemble malignant tumors, so that the diagnosis can be cleared up only by biopsy.

The early diagnosis of laryngeal tuberculosis is, of course, extremely important, and any suggestions that tend to clarify the diagnosis in difficult cases are exceedingly welcome. One of the earliest manifestations of laryngeal involvement is thickening of the posterior commissure, but one must remember that considerable piling up of epithelium may occur

8. Havens, F. Z.: Primary Tuberculosis of the Nasal Mucous Membrane. Arch. Otolaryng. **14**:125 (Aug.) 1931.

in nonspecific inflammations of the larynx, especially in pachyderma. Freystadtl [9] noticed the difficulty of diagnosing lesions in this position in the larynx, and offered a few observations that may help in the differentiation. He said that a thickening of the posterior wall of the larynx, when symmetrical, is not an evidence of tuberculous disease, and that in cases of tuberculosis the lesion is frequently not symmetrical. Further, in a normal larynx the picture changes according to the position of the vocal cords and the width of the glottic chink, whereas a tuberculous infiltration is not altered by the movement of the arytenoid bodies and is not necessarily symmetrical. The subsequent course of the lesion is also of great importance in making a diagnosis. When the thickening is due to a normal anatomic condition it does not change, neither increasing nor decreasing in size, and it never shows ulceration, whereas the tuberculous infiltration has a tendency in the course of time to undergo distinct changes.

Freystadtl's observations are true as far as the normal larynx is concerned, but one frequently sees a pathologic thickening of the epithelium in the posterior commissure owing to chronic inflammation, especially in pachyderma of the larynx. In differentiating the thickening due to simple chronic infection of the larynx from a tuberculous lesion one finds the greatest difficulty. The swelling in both cases is due to a hyperplasia of the epithelium, though this hyperplasia is usually much greater when the exciting cause is tuberculosis. The diagnosis is usually based on the degree of the swelling, the appearance of other portions of the laryngeal mucosa and the presence or absence of a pulmonary lesion.

In making a prognosis in laryngeal tuberculosis one has to take into consideration a number of factors. The local condition of the larynx itself is probably the most important of these, but the amount of the pulmonary involvement and the patient's biologic resistance must be thought of and have an important bearing on estimating the chances of recovery. These factors, to a certain extent, also influence the type of treatment that should be followed; hence the importance of such a careful clinical study as has been undertaken by Videbech.[10] He made 700 sedimentation tests in 108 patients suffering from laryngeal pulmonary tuberculosis, at the same time making careful observations of the changes in weight of the patient and the varying clinical pictures as demonstrated by stethoscopy. Also in 36 patients suffering from pulmonary and laryngeal tuberculosis he made parallel studies of the leukocyte counts according to the modified Arneth-Schilling technic, comparing them with the blood sedimentation reactions.

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9. Freystadtl, B.: Monatschr. f. Ohrenh. **64**:812 (July) 1930.

10. Videbech, H.: Ztschr. f. Laryng., Rhin. **19**:472 (Aug.) 1930; Bibliot. f. læger **122**:423 (Sept.) 1930.

In his conclusions Videbech stated that in patients who show an improved sedimentation reaction or improvement in their clinical symptoms he has never observed any deterioration in the laryngeal disease. On the other hand, the laryngeal condition improved in a number of cases in spite of discouraging clinical signs, loss of weight and unfavorable blood sedimentation tests, though fewer improvements were observed in patients with poor sedimentation reactions. Videbech said, however, that the blood sedimentation test is just as important as far as its prognostic value is concerned as are weight measurements and clinical examinations, and that it must be considered an important addition to the two latter procedures.

Also, he placed a good deal of importance on the Arneth-Schilling count, believing that as a method of prognosis it really has more value in laryngeal cases than the sedimentation reaction. Videbech admitted the probability that the blood picture in cases of pulmonary and laryngeal tuberculosis is chiefly influenced by the pulmonary lesion, but he argued that he was justified in using these methods for prognosis in laryngeal lesions because the quality of the pulmonary infection holds an important clue as to the prognosis of the laryngeal involvement.

During the past two years the large majority of publications on the treatment for laryngeal tuberculosis have centered themselves around heliotherapy and the use of the galvanocautery. Although sunlight or an artificial substitute has been employed for years in the treatment for this disease, it is still being favorably commented on, and the reported results of its use are so much more favorable than those formerly obtained that it is worth while to review some of the more important articles.

Joseph W. Miller [11] brought to America a Wessely machine in 1926, and has since been using it in his clinic in the Beth Israel Hospital. The Wessely radiating machine contains a modified carbon arc light specially designed to double the superficial brightness and thus shorten the time of exposure. The carbons are impregnated by metallic salt in order to produce a greater amount of light at the blue end of the spectrum. These impregnated carbons give out rays that have a wave length of 290,000 millimicrons, embracing the entire ultraviolet of high altitude sun at zenith. By a specially designed Georz system the greatest concentration of rays is thrown to one side and made to converge into a cone through the medium of a quartz optic, the heat rays being absorbed by a water jacket. Patients are treated one at a time, either directly by means of the Seiffert direct universal laryngoscope or indirectly by means of an

11. Miller, J. W.: New York State J. Med. **30**:844 (July 15) 1930; Artificial Sunlight in the Treatment of Laryngeal Tuberculosis, Arch. Otolaryng. **13**:326 (March) 1931.

all-metal laryngeal mirror. The choice of method depends on the condition of the patient, but when the mirror is used the exposure must be longer, as only about 44 per cent of the valuable therapeutic rays are reflected into the larynx. When the indirect method is used, the patient directs the rays himself, his observations being made by means of a large mirror with a central perforation through which the rays are projected. Wessely claimed that out of the 74 patients treated by him only 2 did not respond to this radiation; 59 showed complete healing of the laryngeal lesion with no subjective symptoms referable to the larynx.

Riemer [12] uses an instrument that is somewhat similar to the Wessely. By means of a looking glass placed with its back toward a radiating lamp and in the center of which an opening has been cut to permit the passage of the light rays, the patient directs these rays on to a metal laryngeal mirror with which he reflects them into the larynx. By looking into the mirror just above the opening, he is able to see exactly the direction that the rays are taking. If preferred, this mirror can be hung in the path of sunlight and the sun rays then directed into the larynx just as were the rays from the lamp. When the proper mirror cannot be obtained, an ordinary hand mirror can be used if it is hung so that the edge of the mirror is immediately above the rays that are being directed into the throat.

It would seem that although some practitioners still prefer ultraviolet irradiation in the treatment for tuberculosis the consensus is that more benefit is derived from direct sunlight or from an artificial light closely resembling it in its spectral analysis. Kowler [13] said that in the solar spectrum one has a continuous spectrum, and it is thanks to the absence of long dark intervals that this light, with its mixture of rays and various wave lengths, has given such good results in laryngeal tuberculosis. Kowler prefers this type of light to that produced by an ultraviolet lamp.

Reflected sunlight was advised by Ryan [14] who uses the indirect method with metal laryngeal mirrors. When sunlight is not available, he resorts to the ultraviolet lamp and quartz applicator.

Glenn and McGinnis [15] use the water-cooled mercury lamp with a laryngeal applicator which is a fused quartz rod forming a right angle. When the applicator is in use, the bend is placed against the soft palate so that the short arm is directed into the larynx. Glenn and McGinnis' technic is to give about two or three treatments a week, beginning with a 10 second exposure and increasing 5 seconds at each treatment unless there is some undue reaction. With this apparatus the treatments must

12. Riemer, K.: Ztschr. f. Tuberk. **55**:319, 1930.
13. Kowler: Rev. de laryng. **51**:123 (Feb.) 1930.
14. Ryan, M. C.: U. S. Vet. Bur. M. Bull. **6**:73 (Jan.) 1930.
15. Glenn, E. E., and McGinnis, B. J.: J. Missouri M. A. **27**:7 (Jan.) 1930.

necessarily be given by the physician. Glenn and McGinnis' percentage of improvements or apparent arrest of the laryngeal lesion was fairly high, about 89 per cent, and the average number of treatments per patient was 28.3.

Bacmeister [16] called attention to the fact that all methods of radiation require, at best, a long time, months being necessary before the healing of the lesion can be expected. He said that the best results are obtained in cases that either remain stationary for some time or show some tendency toward improvement. He has obtained much better results from the use of roentgenotherapy, although he recognizes the peculiar sensitivity of the laryngeal mucous membrane to roentgen rays, manifested not only in early but also in late reactions—often from six to fifteen months after the application. Therefore, the dose must be small and given only by a skilled roentgenologist. Bacmeister treated several hundred patients without either early or late reactions and with so much better success than could be hoped for with light therapy that he considers roentgenotherapy a valuable adjunct in the treatment for laryngeal tuberculosis.

A number of writers, in speaking of heliotherapy in the treatment for laryngeal tuberculosis, concede to it a certain value, but believe that it is distinctly secondary to the more active types of treatment, especially the use of the galvanocautery.

Safranek called attention to the fact that it is difficult to get a sufficiently intensive action of the light in the larynx because the rays must necessarily fall not at a right angle but at a tangent, making it practically impossible to reach lesions in the fossa of Morgagni or in other hidden parts of the larynx. He said that it must therefore be apparent that the value of the light is not that it kills the tubercle bacillus or lessens its vitality but that the reaction of the tissues resulting from light treatment increases the blood supply. He said that it has actually been shown that after the treatment there is increased infiltration of cells into the tuberculous area. This inflammatory reaction is more evident after roentgenotherapy, but Safranek believes that the possibility of harm to the larynx from roentgen rays is very real.

To sum up the observations on the use of light in the treatment for laryngeal tuberculosis, those who have had experience in its use claim: (1) that there is an early lessening of the pain, dysphagia disappearing sometimes after three or four treatments; (2) that it requires months of patient application of the light to bring about a cure or an arrest of the laryngeal involvement, and (3) that from 50 to 85 per cent of the patients treated show improvement or cure.

In surgical treatment for laryngeal tuberculosis, bloody surgical procedures have practically been discarded, but the use of the electrocautery

16. Bacmeister, A.: Fortschr. d. Therap. **6**:298 (May 25) 1930.

has received universal endorsement; the difference of opinion concerns only the type of case in which its application is indicated. Safranek has called attention again to the fact that not only does the electrocautery destroy the area reached, but the consequent tissue reaction is much more intensive than that following bloody surgical procedures, and therefore the connective tissue production is much greater. He says further that experimental research has shown that the galvanocautery is curative not only because of the destruction at the point of its entrance but also because it produces a consequent inflammation that really increases the formation of connective tissues in the adjacent region. Emil Wessely also called attention to the importance of an inflammatory reaction following cauterization, but said that it should be used only in patients who have a good regenerating strength. Pryor [17] was more enthusiastic. He said that not only does he get early relief in pain but that with one or two cauterizations he has often been able to heal ulcers and melt away infiltrations that weeks of sunlight had helped but little.

Kellam [18] said that sedative diathermy, as an adjunct to cauterization, not only aids in the relief of pain but stimulates sluggish tuberculous lesions, hastening the healing process. The treatment should be started gently, a comparatively heavy heat should be delivered for the full period of the treatment without interruption and the treatment must be terminated gently. He places the center of a 4 by 6 indifferent electrode over the spinous process of the third cervical vertebra and the center of a 2½ by 4¼ active electrode over the pomum adami. Starting with 200 ma. and gradually increasing this to 800 ma., this dosage should be maintained for fifteen minutes and then the current should be slowly reduced to zero. This treatment should not be given until twenty-four hours after cauterization.

Katz [19] has brought forward the use of trichloracetic acid in the treatment for laryngeal tuberculosis. He said that it is a specific in ulcerative and edematous lesions. Where there is much tumor formation this should be reduced first with the electrocautery and then treated with trichloracetic acid. The difficulty in applying the trichloracetic acid to a localized area is overcome by a specially devised instrument, consisting of a shallow, spoon-shaped container with a sliding cover which can be opened and closed. The whole tip of the instrument is movable within a sleeve, permitting contact of the tip with any spot of the larynx in the same way as does Corde's instrument. One or two crystals are introduced in the container and locked there; when anesthesia has been obtained by local application, the closed instrument is introduced into the

17. Pryor, W. R.: Kentucky M. J. **28**:494 (Oct.) 1930.
18. Kellam, J. W.: U. S. Vet. Bur. M. Bull. **6**:659 (Aug.) 1930.
19. Katz, B.: Am. Rev. Tuberc. **21**:636 (May) 1930.

larynx to the affected area, and the container is opened, allowing the acid to cover the area. The container is closed before the instrument is withdrawn. Katz said that with this instrument he can avoid burning the normal tissues of the larynx.

I believe that it must be difficult to limit the trichloracetic acid to the diseased area, but if the instrument devised by Katz is sufficiently accurate to prevent a spread of the acid, this drug would have an important place in the treatment for laryngeal tuberculosis. Its action would be exactly that of the electrocautery, producing a lesion that required the formation of granulation tissue to heal it, thereby revitalizing the tuberculous area. I cannot see, however, any advantage in the use of the acid over that of the electrocautery.

One of the most important items in the treatment for laryngeal tuberculosis is rest. This is difficult to obtain as far as the larynx is concerned, chiefly because of the coughing reflex. By enforcing the use of the pencil and pad, one may stop the use of the voice, but the vocal cords are just as much agitated during coughing, if not more so than during talking. If a safe method could be devised for rendering the laryngeal structure immobile, it would be advantageous.

For this purpose, Schugt [20] has revived the idea of injections of alcohol into the recurrent nerve. He uses the method of Leichsenring, which consists of introducing the needle at a point marked on the skin, opposite a space between the cricoid and the first tracheal ring. The needle is pushed through to the spine and then withdrawn from 1 to 1.5 cm., and from 1 to 1.5 cc. of alcohol and procaine hydrochloride solution is injected. Schugt said that paralysis has not always been obtained at the first injection and that these injections must be repeated until the vocal cord does not move. He said that he had never seen any injury to the great vessels or nerves of the neck and in only one case had seen symptoms that suggested a possible injury to the esophagus. If the fluid is injected slowly, it is easy to determine whether the needle has entered the trachea or not. When the injection has been successful the vocal cord may be in either the middle or the cadaverous position. Bilateral injection should never be done on account of the danger of asphyxiation and interference with the coughing reflex, neither of which ever follows a unilateral injection. Paralysis usually lasts from four to eight weeks. Schugt has employed this method of injection in fifteen cases, of which nine showed clinical healing and three improvement; two patients became worse and one was not observed.

Schugt's contention that an injection into the recurrent laryngeal nerve is a comparatively safe procedure has not been borne out by previous observations. I believe that there are few cases in which this method of inducing laryngeal rest is properly indicated.

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20. Schugt, H.: München. med. Wchnschr. **77**:626 (April 11) 1930.

The one drug that still seems to have possible specific value in the treatment for laryngeal tuberculosis is chaulmoogra oil. Van Poole [21] does not use the pure chaulmoogra oil but employs a preparation originated by Dean and Wrenshall. This preparation is made first by breaking up the glycerides into glycerol and the sodium soaps of the fatty acids by saponifying the oil with sodium hydroxide under pressure. The mixed fatty acids are separated, and from these the mixed ethyl esters are prepared by esterifying the crude mixed fatty acids with ethyl alcohol. When the esterification is complete, the ethyl esters come to the top of the solution. In order to obtain them in pure form, they are distilled in high vacuum. To this distillation is added 0.5 per cent iodine. Van Poole instils a few drops of this preparation into the larynx three times a week and obtains very distinct relief from pain and dysphagia. As to the actual curative value of this preparation Van Poole is still somewhat uncertain.

I believe that chaulmoogra oil can be properly used as an adjunct to more active treatment in laryngeal tuberculosis, but whether the preparation used by Van Poole has any value over the pure oil I am unable to say.

A creditable essay on laryngeal tuberculosis has been published by Greene,[22] although the various items that he brings forward are not new to those who have studied recent advances in the knowledge of laryngeal tuberculosis. He reiterates some truths, however, among which there is one that cannot be too urgently brought before members of the otolaryngologic fraternity. This concerns the danger of tonsillectomy, especially under general anesthesia, in cases of pulmonary tuberculosis. Greene said that "tonsillectomy should be reserved for those cases [of pulmonary tuberculosis] suffering from marked constitutional symptoms, as arthritis, neuritis and frequent sore throat and where too the pulmonary lesion is of the inactive or fibroid type." Personally, I should go further than Greene does and say that the bloody removal of the tonsils should never be done under either general or local anesthetic in patients who have or have had a distinct pulmonary lesion. If the tonsils require attention other methods than bloody surgical ones should be utilized, such as cauterization, or, better, electrocoagulation.

21. Van Poole, G. M.: Laryngoscope **40**:132 (Feb.) 1930.
22. Greene, J. B.: South. Med. & Surg. **92**:652 (Sept.) 1930.

Abstracts from Current Literature

Ear

OTITIS MEDIA AS A PEDIATRICIAN SEES IT. JOSEPH BRENNEMANN, J. A. M. A. **97**:449 (Aug. 15) 1931.

The author points out that the pediatrician of necessity is well informed about otitis media because he is the one who sees the patient for the underlying throat infection before the ear is involved. He therefore acquires extensive and practical knowledge of the developmental period of middle ear disease and is able to prognosticate with some assurance in the early case. Pain persisting in spite of the use of 5 per cent phenol in glycerin means a progressive condition, leading usually to spontaneous rupture or paracentesis. Redness of the drum and swelling along the handle of the malleus do not call for a paracentesis. Blebs on the drum are evidence of external otitis and do not indicate a severe otitis media, rather the reverse. Surgical intervention is indicated in persistent bulging of the drum above and about the handle of the malleus. Drums that rupture spontaneously and drain freely fare as well as those which are incised. The author is not in sympathy with the conception that the drum should always be incised in otitis media. Irrigation is contraindicated except for an occasional clearcut indication. Wiping with a dry cotton swab that touches the drum is advocated.

BONAR, Salt Lake City [AM. J. DIS. CHILD.].

ANATOMY AND PATHOLOGY OF PETROSITIS. JOSEPH G. DRUSS, Laryngoscope **41**:394 (June) 1931.

It has been deemed advisable to classify the petrous pyramid and apex anatomically in terms used to designate the types of mastoid processes: namely, pneumatic, diploetic and mixed. Recent exhaustive studies of temporal bones have shown that the percentage of each of these types is practically the same for the mastoid as for the apex. The anatomic structure of the apex was found to be the same on both sides in almost all instances, but it did not follow that in the same temporal bone the structure of the mastoid corresponded to that of the apex. These variations play an important rôle in the spread of infection from the middle ear to the tip of the pyramid. The structures at the apex that are of great importance in this respect are the gasserian ganglion and the sixth nerve.

Infections of the middle ear and antrum have a peculiar affinity for certain groups of cells. According to Neumann they are, in order of their frequency: mastoid process, fossa sigmoida, tegmen tympani and antri, petrosa, including the labyrinth, the posterior limb of the external semicircular canal and the carotid canal. Various paths have been described as the routes of extension from the middle ear and antrum to the apex. In the main they are along the paralabyrinthine cells, along the cells accompanying the eustachian tube, through the carotid canal, through the subarcuate fossa, along the superior and inferior petrosal veins, from an extension of an extradural abscess, or from a combination of these. As the infection spreads through the petrous pyramid it may involve or avoid the labyrinth in its course. In none of four cases studied by the author in which the gasserian ganglion or the sixth nerve was involved was labyrinthitis present. It is concluded that the most common route for the spread of infection through the pyramid is by direct extension through the paralabyrinthine cells. The more cellular the petrous pyramid, the more ideal is the situation for the spread of infection. Involvement of the fifth and sixth nerves may not exist in all cases, even though a localized abscess may be present at the apex. An infection of the

petrous pyramid may break through the cortex of the bone along its course and produce a localized extradural, subdural or brain abscess or generalized meningitis, or it may extend along the dura to involve the gasserian ganglion or abducent nerves. In the group of cases with definite infection at the apex, but without involvement of the nerves, the condition terminated in meningitis or in brain abscess. The paralabyrinthine cells or the cells at the apex may be the seat of a localized collection of pus even though there is little or no infection in the mastoid cells. It has also been demonstrated that infection may subside in the middle ear and mastoid cavity, but will increase in severity as it advances through the petrous pyramid. This condition is frequently seen in the case of a dry resolving middle ear associated with an intracranial complication.

The author is of the opinion that osteitis of the petrous pyramid associated with localized pachymeningitis at the apex, resulting in periganglionitis and ganglionitis, is a frequent cause of Gradenigo's syndrome, although there may be other etiologic factors. He concludes that there is no single constant factor responsible for this syndrome. A thorough understanding of the various anatomic and pathologic changes that occur in the petrous pyramid is emphasized as being absolutely essential in the application of surgical therapy.

SNAPP, Grand Rapids, Mich.

THE SYMPTOMATOLOGY AND DIAGNOSIS OF SUPPURATIONS OF THE PETROUS PYRAMID. SAMUEL KOPETZKY, Laryngoscope **41**:398 (June) 1931.

The symptomatology of suppurations of the petrous tip is divided by the author into four periods: the period of ocular pain and aural discharge, the period of low grade sepsis, the period of quiescence and the terminal stage. The ocular pain is, in the majority of instances, the first symptom to make its appearance, and its location and character are almost diagnostic of suppuration of the petrosal tip. The pain is on the side of the lesion, is limited to the region about the eye and is felt within the orbit itself. It is described as a deep-seated ocular pain and, at the onset, is nocturnal. It is the result of an irritation of the ophthalmic branch of the trigeminal nerve. Of the author's cases, eight presented this typical pain in the eye as the initial symptom. In one patient the pain was present from the onset, while in the remaining seven a varying interval of time elapsed between the simple mastoid operation and the beginning of the pain. If eradication of the purulent focus in the mastoid process and middle ear does not result in a cessation of the pain distributed over the areas supplied by the second and third branches of the fifth nerve, the persistence of the pain, when continuous and not spasmodic, should be considered as indicating the possibility of suppuration of the petrosal tip. In the author's series of cases, either the middle ear continued to discharge until the lesion in the petrous tip was identified and eradicated, or after being dry for a time, a profuse discharge suddenly recurred at the same time as, or shortly before, the onset of the eye pain. Neither the otoscopic picture nor the pathologic findings at operation agreed with that presented by cases of bone caries or secondary cholesteatoma. Operation revealed an unusually large amount of granulation tissue in the antrum or middle ear. Other signs that may appear during this period but that are not diagnostic are transient facial weakness, vertigo, nystagmus and vomiting.

Postoperative temperature following a mastoid operation may result from various factors; consequently no significance can be attached to it unless other symptoms are also present to help determine the source of the fever. The presence of a low grade postoperative sepsis, accompanied by ocular pain and aural discharge, is to be viewed as strong evidence of a suppuration of the petrosal tip.

In the majority of cases in this series there occurred an interval of freedom from all pain of any diagnostic value. This period of quiescence varied in duration from five to nineteen days. Its presence may lead both the patient and the surgeon to conclude that the lesion is clearing up, but in the majority of the author's cases, it coincided with the invasion of the endocranium. In only one

instance did it signify spontaneous evacuation of the suppuration in the tip through the middle ear. It is pointed out that the ocular pain is due to traction exerted on the ophthalmic branch of the fifth nerve because of the inflammatory swelling of the dura in the region of the petrous tip. Consequently the relief of this inflammation will result in a cessation of the pain. As the lesion progresses and if sufficient drainage is not established through the peritubal cells or through the tract of invasion, the upper surface of the apex becomes eroded, either directly under the gasserian ganglion or through the thin bony wall which separates it from the carotid artery. Once a perforation has been formed, the pus makes its way subdurally to form an extradural abscess, which, in time, again causes increased tension on the ophthalmic nerve with a recurrence of pain in the eye. The infection spreads through the subarachnoid space, resulting in a purulent meningitis. The terminal period presents the clinical picture of acute purulent leptomeninigitis. If the patient's life is to be saved and meningitis averted, operative measures for draining the petrous tip must be instituted prior to the stage of quiescence.

SNAPP, Grand Rapids, Mich.

SURGICAL THERAPY FOR THE RELIEF OF SUPPURATIONS OF THE PETROUS PYRAMID (AUTHOR'S ABSTRACT). RALPH ALMOUR, Laryngoscope **41**:405 (June) 1931.

In an abstract of his original paper, the author describes briefly the technic that he has developed for approaching the petrous pyramid. A radical mastoidectomy is first performed, and the root of the zygoma and the anterior canal wall are thinned down to an extent sufficient to bring into view the mouth of the eustachian tube. The tensor tympani muscle and the cochleariform process are then removed. One must keep in mind the anatomic relationship existing between the basal cochlear turn and the carotid canal and between the apex of the cochlea and the eustachian tube. Directly under the roof of the pyramidal portion of the petrosa, the basal cochlear turn is separated from the carotid canal for a minimum distance of 6 mm. With the use of a 1 or 1.5 mm. burr directed at an angle of approximately from 20 to 25 degrees to the axis of the external auditory canal, an opening is made just back of the eustachian orifice, directly under the tympanic roof. The burr then passes into a pyramidal space, the sides of which are formed by the carotid canal in front, the three turns of the cochlea behind and the eustachian tube externally. The apex of the pyramid is below and the base above. Through this space a suppuration in the petrous tip may be drained. The author states that the only injury to be feared is that to the carotid artery, and this may be avoided if it is remembered that the uppermost portion of the carotid canal is below the level of the roof of the eustachian orifice. He also cautions against the use of this procedure in cases in which the abscess within the petrous tip has ruptured subdurally and formed an extradural abscess, such conditions requiring a different method of attack.

SNAPP, Grand Rapids, Mich.

REGARDING MORPHOLOGICAL AND FUNCTIONAL CHANGES OF THE INTERNAL EAR IN ARTERIOSCLEROSIS. G. FABINYI, Laryngoscope **41**:663 (Oct.) 1931.

A detailed study was made of the microscopic sections and the functional hearing tests in twenty-six patients in an effort to determine the relationship between arteriosclerosis and the changes in the internal ear. The findings in each instance were supplemented by the clinical histories and the autopsy protocols. The clinical history of arteriosclerosis was confirmed at autopsy in all cases studied. No cases were included in which there was a clinical history of syphilis or otitis media. The ages of the patients ranged between 47 and 78 years. In addition to the changes noted in the larger vessels and various organs, there was also definite sclerosis of the internal carotid artery and of the cerebral vessels in the

majority of instances. The blood pressure was, as a rule, above normal. Loss of hearing of high tones and advanced age are usually related, but the author reports several cases in which the patients had very little loss of hearing and in which sections of the cochlea did not show much change either in the ganglion cells or in the organ of Corti. But on the whole the loss of hearing was found to be much greater in patients with a high degree of arteriosclerosis and is usually accompanied by more or less atrophy of the spiral ganglion, the nerve fibers in the osseous spiral lamina and the organ of Corti of the basal turn.

Among the findings in this series are: atrophy of the organ of Corti (27 per cent); definite atrophy in the spiral ganglion and nerve fibers of the lower basal coil (65.4 per cent); atrophy of the stria vascularis in the lower basal turn (27 per cent), and atrophy of the cells of the external sulcus (27 per cent). Comparison of the loss of hearing in each group with the findings in the vessels seems to indicate that the condition of the meatal vessels is closely related to the loss of hearing and to the cochlear ganglion.

The author believes that the arteriosclerosis is the cause of the changes found on microscopic examination. While the typical loss of hearing is not constantly present, its presence may be regarded as an additional clinical sign indicating probable cerebral arteriosclerosis.

SNAPP, Grand Rapids, Mich.

THE BIOLOGICAL FACTOR IN ANALYSIS OF OTOSCLEROSIS OR OTITIC SENILITY. HAROLD L. WARWICK, Laryngoscope **41**:757 (Nov.) 1931.

It is contended by the author that the hereditary tendency to otosclerosis is a result of a deficiency in formation of the temporal bone in the fetus and during the early months of infancy. This causes sensitization of cartilage cells of such a nature that in adult life they become responsive to changes in the hydrogen ion concentration of the blood and in the blood calcium, such as occur temporarily during endocrine deficiency or during lactation, or such as occur permanently after oophorectomy and the menopause. As the diet of the mother during pregnancy and lactation is the contributing factor in this deficiency, the author believes that an intensive study of the intake of calcium and of vitamins A and D of the mother at such a time will give some comprehension of the hereditary factor, and consequently give a starting point for the prevention of certain pathologic conditions of the bones which are a probable source of otosclerosis or otitic senility.

Progressive deafness, which is the prominent symptom of otosclerosis, is generally conceded to be caused directly by the intermittent although infinitesimal deposition of mineral salts about the foot plate of the stapes and the margin of the oval window, eventually resulting in fixation of the stapes. The mineral constituents deposited in these cases consist of calcium carbonate and tricalcium phosphate. Consequently, it would seem that a study of the chemistry of deposition of these compounds would lead toward a solution of the process resulting in bony ankylosis of the stapes. Cartilage has a specific absorption affinity for calcium salts. The theory has been advanced that when the cartilage or other matrix becomes saturated with calcium salts and phosphates, any decrease in the carbon dioxide tension of the solution will lead to a precipitation of calcium as carbonate and phosphate in the same proportion as found in bones and calcific deposits generally. Certain substances when introduced into the tissue fluids have far greater powers of absorbing calcium salts and retaining them than have others. Particles of fat, spleen, thymus and other tissues have been found to contain, after a stay of fourteen weeks in the peritoneum, only about 12 mg. of calcium, while a similar piece of cartilage has been found to absorb 154 mg. under the same conditions. Many islands of cartilage are normally found in the tissues comprising the temporal bone, and these have been found to have become ossified in otosclerosis.

The author maintains that otitic senility results from a disturbance of calcium metabolism, but that the calcium metabolism deficit may result from different causes. The pathologic process that takes place is likened to that of arthritis deformans, in which hypertrophic or degenerative changes in cartilage and bone

are accompanied by extraordinary new bone formation in such a way that the bone forming the joint is profoundly affected. Some writers have noted areas of sclerosis throughout the labyrinthine capsule, although predominating at the margin of the fenestra ovalis. In some instances the fenestra rotunda has been found completely ossified. A disturbance of metabolism is believed to produce or aggravate otitic senility, and in this connection the glands of internal secretion have been considered. The type of diet in infancy is also an influencing factor. The author has observed that patients with otitic senility frequently present a history of having been weaned from the breast and fed on sweetened condensed milk at a very early age. This led him to believe that a deficiency of vitamins A and D is a contributing factor in this disease. In condensed milk there appears to be a relative absence of these fat-soluble vitamins, which are very important factors in calcium metabolism. Since the mother is responsible for the food factors contributing to the growth of the child before and after birth, it would seem logical that regulation of her diet, particularly during pregnancy and lactation, would influence the deposition of calcium and the sensitivity of bone cells in the child.

SNAPP, Grand Rapids, Mich.

OTITIC MENINGITIS. ALAIN GASTON, Rev. d'oto-neuro-opht. **9**:397 (June) 1931.

In the pathogenesis of otitic meningitis, the cerebrospinal fluid constitutes one stage in the bacterial invasion and also has a protective function. Originating in the choroid plexuses, it is absorbed by the venous sinuses of the skull through the intermediary of the venous network adjacent to the sheets of liquid covering the brain. These pools of liquid are separated from each other by a close network of subarachnoid tissue, the circulation of which is from the ventricles through the foramina of Magendie and Luschka to the cisterna magna; from there, three pathways are used: (1) through the sylvian canal to the pools over the hemispheres; (2) through the supracerebellar sagittal canal to the interhemispheric fissure, and (3) to the spinal canal. The first route is the most important. Otitic infection may be transmitted to the meninges by way of the bone (contiguity) or through the blood vessels. No lymphatic communication between the ear and the meninges has ever been found. Other pathways are the vestibular aqueducts. Localized inflammation of a venous wall is capable of infecting the spinal fluid without causing actual meningitis. This explains purulent meningitis that is cured by repeated lumbar punctures. The frequency of meningitis in otologic conditions is the direct result of the absorption by the veins of an infected cerebrospinal fluid. An extended obliteration of the venous system of the endocranial surface of the petrous bone is a serious obstacle to drainage of the cerebrospinal fluid and, by inflammatory reaction, causes a hypersecretion. Cases of hypertensive meningitis are thus explained. Chronic otitic infections usually affect the meninges through the bony pathway. The infection being attenuated, meningeal adhesions arise, causing encysted meningitis. Acute otitis and acute flare-ups of chronic otitis reach the meninges by the vascular route and cause a generalized diffuse meningitis. The pools of fluid covering the hemispheres are independent of each other. This explains the paradoxical results often obtained from puncture of the cisterna and the fact that cerebrospinal fluid obtained by lumbar puncture does not always indicate exactly the changes that have occurred.

The variability of the signs and symptoms of a meningeal complication makes a precise diagnosis and prognosis difficult. The problem rests on four fundamental elements: (1) the etiologic factors, (2) the clinical signs, (3) the operative findings and (4) a study of the cerebrospinal fluid. Acute meningitis, occurring in the first days of acute otitis or during certain epidemics of grip, is caused by the invasion of bacteria through vascular channels. Acute early labyrinthitis ends in meningitis in one fifth of the cases. Late labyrinthitis, if let alone, causes meningitis in two thirds of the cases. When labyrinthitis is present, search must be made for the first signs of meningeal irritation (dull headache, stiff neck, sug-

gestion of Kernig's sign) and, especially, slight changes in the spinal fluid. Meningitis following operative intervention is almost always diffuse and of grave prognosis. The complete syndrome of meningitis has a very grave prognosis, particularly when localizing signs are present. Persistence of consciousness is a favorable indication, as is improvement after operation on the auricular focus. Localized meningitis is much less serious. Observations at operation on the mastoid process give valuable prognostic data.

The clinical diagnosis and the results of examination of the cerebrospinal fluid are often in accord, but not always. In France, suboccipital puncture is preferred to lumbar puncture but, except in the cases resulting from labyrinthitis, there is not much choice between them. By their use in certain cases of acute labyrinthitis, meningeal infection will be foreseen, perhaps more frequently by the use of cisternal puncture than by lumbar puncture. Negative results of the examination are without value. Cytologic and bacterial examinations are of some prognostic value. If there are more than 2 or 3 cells per cell of Nageotte, the fluid is abnormal. If the examination for bacteria gives positive results, the prognosis is grave. In otitic infections, Streptococcus mucosus and Pneumococcus III are the most virulent and often lead to fatal complications. Patients with staphylococcic meningitis sometimes recover.

Serous meningitis corresponds to no clinical entity; it is a syndrome, characterized by meningeal signs, hypersecretion and hypertension of the cerebrospinal fluid, which is aseptic, papillary stasis, etc. This syndrome may also be due to tumor, reflex excitations or toxic irritation.

Otitic meningitis is classified as diffuse, localized or associated and as the meningeal reaction. There is one criterion for diffuse meningitis: it is always fatal. The signs of localized meningitis vary according to its location. Certain cases are curable. Gradenigo's syndrome represents a meningitis localized at the point of the petrous pyramid; ventricular hydrops (hypertensive ventriculitis of Sicard) is the result of localization that blocks drainage from the ventricles. Associated meningitis is localized around an abscess, thrombophlebitis or diffuse encephalitis. The criterion of meningeal reaction is its favorable termination. Every case of diffuse meningitis in which recovery occurs is only a meningeal reaction. The meningeal reaction is frequent in children, and is benign if the ear is promptly drained. The fluid is usually sterile, but the presence of pus is not, *a priori*, a fatal sign, as it may be directly infected from the focus of origin. Hautant showed that in such meningitides with septic spinal fluid and favorable outcome the patients never show signs of paralysis.

Preventive treatment consists in the radical exenteration of the mastoid process in chronic otitis. A labyrinthitis that lasts more than eight days, with increasing lymphocytosis in the spinal fluid, requires drainage of the labyrinth.

Every meningeal reaction demands intervention: removal of the auricular focus, drainage of the subarachnoid spaces and antibacterial remedies. The observations at operation will determine the procedure: mastoidectomy, sinus opening, evacuation of extradural or brain abscesses, and drainage of the labyrinth if the meningitis follows a labyrinthitis. In cases of hypertensive meningeal reaction without localizing signs, repeated lumbar and cisternal punctures suffice, but large quantities of fluid must be withdrawn. If localizing signs are present, temporal or suboccipital decompression must be added if the hypertension persists. If signs of localization and hypertension still persist, the encysted fluid should be removed, the point of election being revealed by the localizing signs. Ventricular puncture is indicated in hydrops of the ventricle. In diffuse purulent meningitis, the gravity of the case warrants the successive carrying out, in the minimum of time, of all measures for draining the subarachnoid space: spinal punctures, two or three times daily, drainage of the pontocerebellar lake, translabyrinthine drainage and ventricular and spinal punctures. But, when recovery occurs in a case of septic meningeal reaction, spinal drainage suffices in most cases.

DENNIS, Colorado Springs, Colo. [ARCH. NEUROL.].

CASE OF BILATERAL ABOLITION OF VESTIBULAR APPARATUS WITH NORMAL HEARING. F. SÖDERBERG, Arch. f. Ohren-, Nasen- u. Kehlkopfh. **129**:335 (Aug. 18) 1931.

The question as to how a human being localizes auditory impressions has, according to Söderberg, been the object of many investigations. The theories concerning this problem he classifies in two main groups, the acoustic and the nonacoustic, and he discusses particularly those that consider the vestibular apparatus as the site for localization. Although the vestibular theory has been widely accepted, the author and several other investigators pointed out that in order to clarify this problem it would be necessary to examine a number of persons with bilateral abolition of the vestibular function and with preserved audition. The author describes one such case that came under his observation. There was a spontaneous horizontal, rotatory nystagmus on the right side. The nystagmus on the left, which developed when the patient looked to the left, was weaker. When standing with closed eyes he staggered, and walking with closed eyes was insecure and atactic. The labyrinths could not be influenced by caloric, galvanic and rotatory stimulants. These tests revealed the bilateral abolition of the function of the vestibule. The anamnesis indicated that the injury had developed during childhood, and the results of roentgenoscopy made it probable that a bilateral infectious process had been the cause. However, it is not the author's object to investigate the etiologic factors or the lesions that led to the abolition of the vestibular function; but he wishes only to demonstrate that this case, with its abolition of the vestibular function, the normal hearing capacity and the normal sound localization, is a proof of the untenability of the theory of vestibular localization of sound.

EDITOR'S ABSTRACT.

TWO CASES OF TUMORS OF THE LIDS CAUSED BY FOREIGN BODIES AFTER OPERATION FOR ACUTE MASTOIDITIS. H. MITA, Klin. Monatsbl. f. Augenh. **86**:59 (Jan.) 1931.

Two school children, a boy aged 8 years, and a girl aged 7 years, had granugenol oil, a German proprietary form of a liquid petrolatum preparation, applied to their wounds after an operation for acute mastoiditis of the left ear. In the case of the boy the left side of the face was swollen soon after the operation, leaving solid, hard tumors in the lids, lodged chiefly in the epidermis, and somewhat in the tarsus and in the orbital wall. These tumors persisted for over a year. The same phenomena were noticed in the girl about a week after the operation. The orbits, globes and their motion were not involved in either case, nor were the preauricular glands palpable. An attempt completely to shell out the tumors failed. The palpebral fissures remained narrowed. Histologic examination showed proliferating endothelial cells, partly in the process of necrosing or of transformation into connective tissue. Polymorphonuclear giant cells of various size were scattered all over. A portion of the connective tissue presented a fibromatous structure; numerous round alveolae resembling fat cells were in evidence. The foreign matter producing the tumors was an oily substance which, in the author's opinion, may have been carried from the field of operation to their present location by way of the perivascular lymph spaces. The histologic picture reminded Mita of the granulomas observed in the vicinity of the root of the nose after injections of paraffin for cosmetic purposes. Granugenol does not contain pure paraffin. No similar adverse results have been published.

STOLL, Cincinnati [ARCH. OPHTH.].

ANATOMY OF DEAFNESS RESULTING FROM CEREBROSPINAL MENINGITIS: HISTOLOGIC ASPECTS OF CHRONIC LATENT OTITIS INTERNA. K. ISHIHARA, Monatschr. f. Ohrenh. **65**:1199 (Oct.) 1931.

Because the literature on the histologic aspects of postmeningitic deafness is limited, Ishihara feels justified in reporting a case that, for a number of years,

had been under clinical observation and that at postmortem examination revealed noteworthy histologic aspects. The meningitis developed in January, 1915, when the girl was in her fourth year. Deafness set in on the fourth day of the meningitis, but neither vertigo nor nystagmus was observed, and the author thinks that this is due to the fact that deafness and the exclusion of the labyrinthine function developed on both sides simultaneously. In her sixteenth and seventh years, the patient complained of attacks of dizziness before and after menstruation, but it is not likely that these attacks were of labyrinthine origin, for repeated clinical tests revealed the labyrinths as unexcitable. However, it is pointed out that even thirteen years after the beginning of the labyrinthine disease (the patient died in 1928, in her seventeenth year), there was yet a remnant of the labyrinthine neuro-epithelium, and it was connected with the nerve, which, to be sure, was atrophied to a considerable degree. Thus the histologic aspects of the right ear indicate the possibility of a slight labyrinthine vertigo. The attack of unconsciousness, which the patient experienced during 1927, is ascribed to the congenital narrowness of the vascular system, and it is assumed that such an attack was the cause of the patient's sudden death. The author describes the results of the necropsy and of the histologic examination of both ears. The latter corresponds with the results of the functional tests, which indicated bilateral deafness and loss of the labyrinthine function. However, it seems surprising that, although the deafness developed simultaneously on both sides and was caused by the same disease, the histologic changes in the two ears show considerable differences. The author describes numerous sections of both ears and also summarizes the differences in the histologic aspects. As one of the differences, he points out that whereas in the left ear the inflammation of the internal ear had completely healed, in the right ear there still were signs of inflammation. However, some of the changes were the same in both ears.

EDITOR'S ABSTRACT.

SYMPTOMATOLOGY AND CASUISTICS OF LATENT OTOGENIC CEREBRAL ABSCESSES. A. SCHWARZBART, Monatschr. f. Ohrenh. **65**:1236 (Oct.) 1931.

In reviewing the casuistics of otogenic cerebral abscesses, Schwarzbart points out that these cases are comparatively rare, and he stresses that the rarity makes the diagnosis more difficult, and that the late recognition in turn makes the prognosis more unfavorable. A careful study of the symptomatology of all cases is therefore of great importance. The author gives the clinical history of two patients, of a boy, aged 10, and of a nursling of 8 months. After discussing the mode of infection and the bacteriologic aspects, he discusses the peculiarities of both cases, especially those that are of significance for the symptomatology of the latent stage. In both patients there existed a progressive protrusion of the dura, for it had been exposed by an operative intervention. This protrusion indicates a cerebral abscess. Another significant symptom that was observed in the first patient is a tingling sensation in the toes. In connection with other symptoms, such as bradycardia, apathy and constipation, it should, in an apparently latent case, direct the physician's attention to a cerebral process. The third significant symptom is the abnormality of the white blood picture. The eosinophil count is below normal, and the traces of basophils disappear. There also are lymphopenia, marked leukocytosis and neutrophilia, monocytosis, increasing deviation to the left on the part of the neutrophils and an increased leukocyte index. Such a blood picture indicates, of course, only the presence of an active infectious condition, but in connection with signs such as the protrusion of the dura it indicates intracranial complications. The author emphasizes that the diagnosis otogenic cerebral abscess should not be restricted to manifest cerebral symptoms, for the latter are dependent on too many factors. In the conclusion he again sums up the three symptoms that he considers helpful in diagnosing a latent cerebral abscess, namely, paresthesia (tingling in the toes), protrusion of the dura and the abnormal white blood picture.

EDITOR'S ABSTRACT.

EXPLORATORY EXPOSURE OF MASTOID PROCESS IN DIAGNOSIS OF MASTOIDITIS AND IN PROPHYLAXIS OF OTOGENIC INTRACRANIAL COMPLICATIONS. P. BROSCHNIOWSKI and I. BARYSCHNIKOW, Monatschr. f. Ohrenh. **65**:1245 (Oct.) 1931.

On the basis of observations in 360 operations on the mastoid process, Broschniowski and Baryschnikow reach the following conclusions: 1. In cases in which the diagnosis mastoiditis is somewhat doubtful, the exploratory antrotomy is the only convincing and safe method to corroborate or to exclude mastoiditis. 2. During a suppurative otitis media, even if the exploratory antrotomy does not corroborate the assumed mastoiditis, the intervention is not only of diagnostic but also of therapeutic value since it facilitates drainage of the tympanic cavity. 3. The condition of the operative field and the clinical aspects indicate whether it is necessary to extend the exploratory antrotomy by a greater exposure of the mastoid process. 4. In cases of mastoiditis it is usually advisable not to limit the surgical intervention to an antrotomy, but to open also the main groups of the mastoidal cell system, and to expose the sinus, for only in this manner will it be possible to detect distant pathogenic foci and to prevent the spreading of the disease process.

EDITOR'S ABSTRACT.

MANEUVER FOR OPENING SPASMODICALLY CLOSED EUSTACHIAN TUBE DURING CATHETERIZATION. Z. WEIN, Monatschr. f. Ohrenh. **65**:1253 (Oct.) 1931.

In the introduction, Wein stresses the great significance of the ventilation of the middle ear and then mentions the various causes of insufficient ventilation. Some of these causes can be removed by surgical intervention, but in some instances the occlusion is the result of inflammatory swelling of the comparatively narrow eustachian tube. In the latter cases inflation of the middle ear becomes necessary, and this is usually done by means of politzerization. However, the author points out that Politzer's method is not always effective, for in many cases the air does not reach the middle ear. If auscultation by means of the otoscope, which should always be combined with politzerization, reveals that the air does not reach the midde ear, catheterization should be resorted to, for the author considers it by far the more effective procedure, but he admits that even the use of the catheter does not always open the eustachian tube, for the pharyngeal reflexes, such as coughing and retching, which often accompany the introduction of the catheter, cause a spastic contraction of the pharyngeal orifice of the tube, and prevent the air from entering. This can be overcome by cocainization of the pharyngeal ostium of the tube. Besides excluding the reflexes, cocainization also has a therapeutic value in that its epinephrine content effects vasoconstriction and by this reduces the swelling of the mucous membrane. But even the exclusion of the disturbing reflexes is often not sufficient, especially not in nervous, apprehensive patients. In order to divert the attention of such persons from the site of the intervention, the author recommends Jendrassik's maneuver. However, in this case the hooking and the pulling of the fingers have not the aim to emphasize the reflexes but rather to divert the patient's attention.

EDITOR'S ABSTRACT.

AUDITION DURING NOISE. B. LANGENBECK, Ztschr. f. Hals-, Nasen- u. Ohrenh. **30**:1 (Oct.) 1931.

In regard to paracusis, Langenbeck agrees with von Troeltsch, Siebenmann and Burger, who explain the phenomenon that patients with baryecoia hear comparatively better in noisy surroundings than persons with normal hearing as an "illusion." The person with baryecoia is less annoyed by the noise than the person with normal hearing, and as a result the latter hears nearly as badly as many persons with an impaired hearing capacity. Susceptibility to noise is reduced in persons in whom the baryecoia is a result of conduction disturbances, but in

persons with nervous baryecoia it is increased. In examining the normal hearing capacity for pure tones during noise it was found that, disregarding certain exceptions, the impairment of hearing caused by noise does not develop in the sound conduction apparatus but centrad from it. The author also observed the greater importance of the noises with a low pitch, for these noises are most injurious to the auditory apparatus, and it is also probable that these types of noises are most frequent in everyday life. Hearing during noise is not determined by the absolute sensitivity but by differentiation sensitivity. For this reason, the tests for the determination of the auditory threshold for pure sounds should be made in noisy surroundings, for only in this manner can the differentiation capacity be determined. It is not sufficient to test the hearing capacity of a patient in noiseless surroundings, for efficiency in an occupation is determined by the hearing capacity during noise.

EDITOR'S ABSTRACT.

A NEW METHOD FOR THE PHYSIOPATHOLOGIC EXAMINATION OF THE EAR. S. J. CROWE and W. HUGHSON, Ztschr. f. Hals-, Nasen- u. Ohrenh. **30**:65 (Oct.) 1931.

Crowe and Hughson direct attention to a test by which Wever and Bray were able to reproduce sounds that enter the ear of an animal. One electrode is introduced into the auditory nerve or brought near it, and the other electrode is introduced into the muscles of the neck. An amplification apparatus and a loud speaker are joined into the circuit. Wever, Bray and others employed this method for investigations on action currents and on the localization of cerebral auditory centers; however, Crowe and Hughson found it helpful in determining the normal function and physiopathology of the auditory apparatus. This test makes it possible to study every structure of the middle and the internal ear, the modification of sound transmission by localized lesions of the tympanic membrane, of the auditory ossicles, of the membrane of the fenestra rotunda, of the tensor tympani and of the stapedius, and the changes in intralabyrinthine pressure. Following preliminary tests that corroborated the results of Wever and Bray, the authors made tests on those portions of the ear which are active in sound conduction. Experiments on cats showed: 1. The removal of the external ear or the obstruction of the external auditory meatus reduced the intensity of the sound considerably. These portions obviously effect concentration of the sound waves on the auditory apparatus. 2. An incision into the tympanic membrane does not impair the sound transmission through the middle and internal ear. If such an incision is followed by a reduction in sound transmission, some structure in the middle ear has been injured. 3. For the conduction through the middle ear it is necessary that the chain of the auditory ossicles is intact. Changes in the incudomalleal joint or in the incudostapedial articulation make conduction impossible for all sounds of less than 4,096 double vibrations. 4. A certain tension of the tensor tympani prevents the conduction of all spoken words and of pure tones up to 2,048 double vibrations, but as soon as the tension relaxes, the conduction becomes normal again. Division of the tensor tendon, at the site of attachment on the malleus, effects, after an interval of ten days, a considerable reduction in the intensity of all tones of over 1,024 double vibrations, whereas sounds within the range of the normal voice remain unchanged. 5. Pressure on the membrane of the fenestra rotunda of anesthetized cats increases the clearness and the intensity of the sounds of the speaking voice and of all pure tones between 512 and 4,096 double vibrations. This manifestation is noticeable in normal as well as in pathologic ears. The membrane of the fenestra rotunda evidently acts as a safety valve for the protection of the structures of the internal ear. As a result of its mobility, it absorbs a large percentage of the sound impressions.

EDITOR'S ABSTRACT.

BESREDKA'S ANTIVIRUS THERAPY AND ITS ACTION IN FURUNCULOSIS OF THE AUDITORY MEATUS. R. KURZHALS, Ztschr. f. Hals-, Nasen- u. Ohrenh. **30**:98 (Oct.) 1931.

Kurzhals points out that instead of administering the usual serotherapy that influences the entire organism, Besredka applies bacterial substances locally as a result of the observation that certain bacteria have an elective affinity for certain sites and organs and that the derivatives of the viruses, the antiviruses, have a specific and elective action. After describing the production of the antiviruses, the author reviews the opinions of other investigators concerning Besredka's antivirus therapy. Some assert that it is not due to a specific action, some deny the favorable results and others corroborate the favorable action. The author employed the antivirus therapy in thirty patients with furunculosis of the auditory meatus. The mixed staphylococcus antivirus was brought into the auditory meatus, and the latter was closed by a cotton tampon. The most favorable effect of this treatment was the rapid disappearance of the pain. The objective symptoms disappeared more slowly. The simultaneously existing suppurations of the middle ear were not influenced, but this had not been intended. In view of the favorable results obtained by him the author recommends this treatment.

EDITOR'S ABSTRACT.

A CASE OF DIFFUSE, ACUTE OTOGENIC OSTEOMYELITIS OF BOTH TEMPORAL BONES. J. ALPIN, Ztschr. f. Hals-, Nasen- u. Ohrenh. **30**:105 (Oct.) 1931.

Alpin gives the clinical history of a boy, aged 13 years, in whom the clinical picture, the operative status and the postoperative course indicated the presence of fulminating, septic otogenic osteomyelitis of both temporal bones. The patient recovered because a wide resection of the bone checked the further spreading of the process and because an intracranial complication (sinus thrombosis) was removed. The reported case is of special interest for the following reasons: its great rarity, favorable outcome, relapse-free course during a period of two years and the complete epidermization of the large trepanized cavities. Since the patient had normal hearing capacity before, bilateral infectious toxic neuritis of the cochlear nerve is assumed.

EDITOR'S ABSTRACT.

A CASE OF OSTEITIS FIBROSA (PAGET) OF THE TEMPORAL BONE. H. BRUNNER, Ztschr. f. Hals-, Nasen- u. Ohrenh. **30**:110 (Oct.) 1931.

Brunner's purpose in reporting this case is not merely to increase the small casuistics (nine cases, excluding the one reported), but to call attention to certain peculiarities, not found in other cases, which throw new light on the nature of this disease and on its relations to the membranous labyrinth. After giving a detailed description of the histologic observations on the temporal bones, he discusses the various theories of the nature of osteitis fibrosa. He shows that a considerable number of pathologists assume an irritative nature for osteitis fibrosa, but that many others refute this theory. In the reported case edema was noted in the medullary spaces, and at first this was thought to be the result of circulatory disturbances (transudate). However, this explanation was unsatisfactory in regard to the perivascular infiltrates. Since the patient had had neither meningitis nor otitis, nor any other septic disease, and since there were no signs of leukemia, the perivascular infiltrates have to be traced to the osteitis fibrosa. The author thinks that this establishes definitely the inflammatory, or at least the irritative, character of osteitis fibrosa. Moreover, this theory offers a better explanation of the serous exudates into the internal ear. In establishing the inflammatory character, nothing is yet known about the cause of the inflammation.

EDITOR'S ABSTRACT.

ANATOMICOPATHOLOGIC INVESTIGATIONS ON ARTERIOSCLEROSIS OF THE INTERNAL AUDITORY ARTERY. H. WANGEMANN, Ztschr. f. Hals-, Nasen- u. Ohrenh. **30**:135 (Oct.) 1931.

In order to determine whether and to what extent the internal auditory artery is predisposed to arteriosclerosis, Wangemann examined it post mortem in thirty-one men and nineteen women. Arteriosclerotic changes were found in twenty-nine of the hundred arteries examined. In thirteen cases (that is, in twenty-six arteries) the changes were bilateral, and in only three cases, unilateral. A tabular report indicates that in the majority of cases the sclerotic changes were slight; in nine cases they were somewhat more pronounced. Changes that obliterated the lumen entirely, or to a considerable degree, were never observed. While 29 per cent of the internal auditory arteries showed sclerotic changes, examination of the other basilar cerebral arteries revealed sclerotic changes in 88 per cent of the cases. The coronary vessels showed pathologic changes in 88 per cent of the cases and the aorta in 90 per cent. From these observations the author concludes that in cases of general sclerosis and even in those of pronounced sclerosis of the basilar cerebral vessels, the internal auditory artery has no special predisposition to sclerosis. In cases in which the sclerotic changes of the basilar cerebral arteries are only slight, the internal auditory artery is generally free from sclerotic changes. It must therefore be stated that the artery of the internal ear has no special predisposition to sclerotic changes.

EDITOR'S ABSTRACT.

Pharynx

THE EFFECT OF TONSILLECTOMY IN ALLERGIC CONDITIONS. STEARNS S. BULLEN, J. Allergy **2**:310 (July) 1931.

From the study of 600 patients of various ages and the records of 2,000 school children presented by Dr. Albert D. Kaiser, the conclusions are reached that (1) "tonsillectomy does not aid in improving the results of treatment of nasal or pulmonary manifestations of allergy; rare exceptions may occur; (2) nasal or pulmonary manifestations of allergy are as liable to occur in an individual whose tonsils have been removed as in one who retains his tonsils."

HOYER, Cincinnati [AM. J. DIS. CHILD.].

TECHNIC OF TONSILLECTOMY IN CHILDREN. P. OHNACKER, Ztschr. f. Hals-, Nasen- u. Ohrenh. **30**:94 (Oct.) 1931.

Ohnacker describes his modification of Sluder's method and then emphasizes two factors that are of special significance in children, namely, the behavior of the veins and the softness of the tonsils. The veins in the tonsillar bed are comparatively stronger in children than in adults, and are injured more easily; however, this is no cause for alarm, for a clamp will suffice to check the hemorrhage. Because of the softness of the infantile tonsils, special care has to be taken so that the grasping forceps does not slip.

EDITOR'S ABSTRACT.

PHONIATRIC STUDIES FOLLOWING TONSILLECTOMY. R. IMHOFER and K. KOHN, Ztschr. f. Laryng., Rhin. (Teil 1: Folia oto-laryng.) **21**:555 (Oct.) 1931.

Imhofer and Kohn studied the changes in the articulatory organs following tonsillectomy by (1) analyzing the changes in speech developing immediately following tonsillectomy; (2) determining the factors that influence the intensity of the disturbance, and (3) investigating whether tonsillectomy may cause permanent speech disturbances. They state that their technic was comparatively simple. After the tonsils had been carefully inspected and the mobility of the velum palatinum had been determined, certain sound tests were made, and in addition to these auscultation and manometer tests. The studies were made on fifty patients. In twenty-one, articulatory changes were not demonstrable, in spite of the fact that several complained that speaking was painful. This seems to be dependent on the

subjective attitude of the individual patient to the pains; some persons avoid speaking in order to avoid pains, while others feel that they should overcome them and strive to articulate plainly in spite of the pains. The authors think that the latter attitude is to be recommended. In twenty-eight cases speech disturbances were noticeable, and one case is disregarded because speech disturbances existed before the operation. In summing up their observations, the authors state that in the majority of cases tonsillectomy is followed by an inhibition in the function of the articulatory organs, but gradually the inhibition disappears and sometimes there is even an improvement compared with the preoperative status. The intensity of the visible reaction and also the degree of impairment detectable with the phoniatric methods of investigation do not always correspond to the speech disturbance; this is due, as explained, to the attitude toward pain on the part of the individual patient, and it is especially noticeable in the case of the jaws, for the stiffness has no organic cause, and it persists much longer than the impairment of the function of the velum. The authors maintain that as soon as the danger of hemorrhage is over, which at the latest is on the second day following the operation, the articulatory organs may be used for ordinary speaking without resorting to whispering. Phoniatric after-treatment is rarely given following tonsillectomy, and the authors agree that in the majority of cases it is unnecessary.

EDITOR'S ABSTRACT.

Larynx

OBSERVATIONS ON PARALYSIS OF THE RECURRENT LARYNGEAL NERVE. ALFRED MICHAELIS, Laryngoscope **41**:687 (Oct.) 1931.

A lesion of the recurrent laryngeal nerve with a resulting paralysis of one vocal cord is a common occurrence, but may easily be overlooked, both because of lack of subjective symptoms in the patient himself and because of careless methods of examination. Patients with the cord in the cadaveric position, with distortion of the larynx, with muscular atrophy or with an inability of the sound cord to effect closure of the glottis will present definite vocal defects and will reveal a readily recognized pathologic picture in the larynx on examination. But the earlier stages of the lesion may readily escape observation. In a series of twenty cases reported by the author thirteen patients had loss of motion of one vocal cord without impairment of the voice; four had loss of motion of one vocal cord without hoarseness, but presented visible pathologic conditions elsewhere suggesting the cause, and three had loss of motion of one cord with definite hoarseness. The associated pathologic process in the second group consisted of trauma following operations on the neck in two instances and syphilis and enlargement of the thyroid gland in the other two patients. Tuberculosis was an important factor in the three cases in the last group.

The author describes a technic of examination that will readily disclose any loss of motion of a vocal cord, even though very slight. This consists in watching the arytenoids during phonation instead of concentrating on the cords during this function. The arytenoid of the affected side always remains fixed, while the normal one moves against it or impinges on it. The observer who looks fixedly at the vocal cords during phonation will appear to see an excursion of both toward the median line, whether both or only one are functioning normally. This is due to the overaction of the normal cord in its effort to effect the closure of the glottis, which gives the appearance of motion to a really motionless cord. The author refers to the phenomenon as an optical illusion and warns against being misled by it. The anatomy of the nerves is to a great extent responsible for their involvement. The longer and more exposed left nerve was involved in nineteen of the twenty cases reported, while the shorter right one suffered only once. Close cooperation with a competent internist is highly essential in order to locate the pathologic lesion in many of these patients.

SNAPP, Grand Rapids, Mich.

CANCER OF LARYNX HEALED BY ROENTGEN TREATMENT. Z. WEIN, Monatschr. f. Ohrenh. **65**:1183 (Oct.) 1931.

Wein reports the clinical history of a man, aged 62, who did not submit to an operative intervention for cancer of the larynx until the growth had progressed to an inoperable stage. As a last resource roentgen irradiation was resorted to. Three treatments were given in rapid succession (three and two days apart) on the right side of the neck, on the left side and on the front. The focus distance was 30 cm., and the tension was 160 kilovolts. The rays were applied through a filter consisting of 0.5 mm. zinc and 1 mm. aluminum. The author thinks that about 40 per cent of the 100 per cent surface dose applied at each session becomes effective at the depth of the location of the growth. Thus a comparatively large amount was applied, but the grave condition of the patient justified such large doses. As a result of this treatment, the patient's condition improved from day to day. After more than a year the patient was still well. The author's object in reporting this case was to show that roentgen therapy deserves a trial in the severest cases of laryngeal cancer. He concedes that probably not every type of cancer reacts in such a manner as to effect cure, but most authorities agree that roentgen treatment at least alleviates the suffering, inhibits the further growth, reduces edema and the resulting tension and by this facilitates breathing and swallowing. The types of cancer that yield most readily to roentgen rays are the papillomatous and the basocellular. In the conclusion, the author points out that he does not wish to give the impression that irradiation should replace surgical measures. On the contrary, he thinks that as long as the cancer is operable, surgical treatment should be resorted to. He also calls attention to the fact that some surgeons employ roentgen rays as postoperative treatment.

EDITOR'S ABSTRACT.

Nose

CONSERVATIVE TREATMENT OF OZENA. K. KOHN, Monatschr. f. Ohrenh. **65**:1168 (Oct.) 1931.

Kohn first mentions the various forms, and then discusses the various theories of pathogenesis on which therapeutic measures have been based. He thinks that most therapeutic measures, even surgical, are symptomatic. The main object is usually an irritation of the mucosa and a stimulation of its regeneration. Because surgical treatment has not brought the desired results, there is now a greater tendency to employ conservative measures, and the author considers Hermann's suction method as one of the best. It employs a balloon, in the proper use of which the patient has to be instructed. The principle of the treatment is the production of a negative pressure which effects hyperemia. In patients in whom there is marked crust formation, the nose should be irrigated with an astringent before the suction treatment. The patients should be advised to treat themselves from three to four times daily, introducing the balloon from fifteen to twenty times at each treatment. The author found this treatment effective in a number of cases that had been refractory to all other treatments. The mucous membrane shows signs of regeneration, and the patients state that nasal breathing improves. The fetor disappears in most cases after the treatment has been continued for from two to three months. However, it is not advisable to discontinue the self-treatment at this time, but it should be continued for at least six months, even if all the symptoms have disappeared before that time.

EDITOR'S ABSTRACT.

RULES FOR OPERATIVE TREATMENT IN ATRESIA OF NOSTRILS. D. N. MATWEJEW, Monatschr. f. Ohrenh. **65**:1188 (Oct.) 1931.

After calling attention to the disorders that may result from atresia of the nostrils, Matwejew enumerates the conditions that may cause atresia, such as smallpox, diphtheria, scarlet fever, eczema, lupus, tuberculosis, syphilis and all conditions in which ulceration of the nasal mucous membrane exists. In rare instances the atresia is congenital. As one of the most frequent causes of atresia,

the author considers smallpox, for all of the cases that were treated by him were caused by it. The pustules at the entrance of the nose cause cicatricial contraction of the nostrils or even complete closure, and the cicatricial changes in the skin around the nostrils constitute a great difficulty in the plastic correction of atresia, for the condition usually returns. To avoid a relapse, the author suggests the following rules for the operative treatment: 1. In the area of the operative field the epitheliated cutaneous covering should be preserved even where it is cicatrized. 2. In order to avoid the contraction of the cutaneous covering, the subcutaneous cicatricial strands should be removed. 3. All wound surfaces produced by the surgical intervention should be covered with epitheliated skin. After giving a detailed description of his operative technic, the author expresses the hope that his method will be employed by others.

EDITOR'S ABSTRACT.

Miscellaneous

OSTEODYSTROPHIA FIBROSA OF FACIAL SKULL, ESPECIALLY ITS PATHOGENIC POSITION. A. GREIFENSTEIN, Arch. f. Ohren-, Nasen- u. Kehlkopfh. **130**:1 (Oct. 8) 1931.

In a case of osteitis fibrosa, Greifenstein noted an unusual unilateral limitation of the process to the upper and lower jaws. He points out that the roentgenologic aspects of osteodystrophia fibrosa are not uniform, but correspond to the changing conditions of the rapid transformation between fibrous tissues and old or newly formed bones. A second case shows that the histologic aspects of epulis and of osteodystrophia fibrosa cannot be differentiated from those of the nonspecific osteoclastic resorption tissues. By his own observations as well as by reports from the literature, the author shows that the histologic aspects of osteodystrophia fibrosa can be produced by various local (among them also traumatic) and general injuries of the bony system. Regardless of the changes in the pathologico-anatomic interpretation of osteodystrophia fibrosa, the designations for the various clinical forms belonging to this group are to be maintained, since etiologic differentiation is as yet impossible. A short reference is made to pathologico-anatomic conditions that resemble osteodystrophia fibrosa of the facial skull.

EDITOR'S ABSTRACT.

PERCAIN AS ANESTHETIC. K. FUCHS, Monatschr. f. Ohrenh. **65**:903 (Aug.) 1931.

In the introduction, Fuchs gives a history of percain (also termed nupercain). Then he discusses its pharmacology, and further its use as a local anesthetic and for surface anesthesia. He reviews the literature and also relates some of his own observations. In the conclusion, he states that reports on about 10,000 cases indicate that percain is used with best success. The secondary effects are not more marked than in the case of any other local anesthetic, and in many respects it surpasses other local anesthetics. The author also gives an extensive bibliography on percain.

EDITOR'S ABSTRACT.

CONSTITUTION AND VOICE IN THEIR CHARACTEROLOGIC RELATION. P. MOSES, Ztschr. f. Hals-, Nasen- u. Ohrenh. **30**:77 (Oct.) 1931.

In the introduction Moses directs attention to his former publications on this subject and to the studies by Dalma. He deplores the fact that the literature on constitution, especially the treatises of Kretschmer and of Bauer, completely disregard the relationship to the voice. His own studies convinced him that from the melody of the speech, from the pitch of the voice, from the pathos and from the nasal resonance one can draw conclusions as to the constitutional type of a person. He discusses each of these factors in the different constitutional types. He observed high-pitched voices in the schizoid type, and in the pyknic type he noted baritonal

voice ranges. But what seems more important to him is the fact that in schizoid persons there is a predominance of the head voice (high tenor), whereas the chest voice (baritonal range) characterizes the pyknic type.

EDITOR'S ABSTRACT.

SURGICAL TREATMENT FOR EAR DURING EARLY CHILDHOOD AND PNEUMATIZATION DEVELOPMENT. H. LOEBELL, Ztschr. f. Laryng., Rhin. (Teil 1: Folia oto-laryng.) **21**:326 (July) 1931.

In order to learn the later fate of children who had undergone antrotomy during early childhood, Loebell studied the development of pneumatization of the mastoid process by means of roentgenoscopy. A tabular report shows the results of the examinations in 20 cases. In 14, that is, in two thirds of the cases, the pneumatization was inhibited, particularly on the side that had been operated on; in the other 7 cases it was normal. In reviewing the results of several other workers who have investigated this problem, he found that their conclusions were contradictory. He thinks that this is due to the fact that most investigations were made on a comparatively small material, and he therefore considered it advisable to study the normal pneumatization process on those persons who had not had otitis media during childhood or in adult life and also on persons who had had otitis in later life, after pneumatization had been completed. Investigations on 100 cases revealed that in 23, that is, in more than 20 per cent, there was marked inhibition of the pneumatization. This indicates that the inhibited pneumatization cannot be considered as the result of otitis media and of antrotomy, and the author thinks that more investigations, roentgenologic as well as histologic, will be necessary to solve the problem of pneumatization. Observations on 25 patients with ozena revealed in 11 of them normal pneumatization, and in 14 bilateral inhibition.

EDITOR'S ABSTRACT.

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ABSTRACTED BY ALFRED LEWY, M.D.

HEREDITARY AND CONSTITUTIONAL PATHOLOGY OF THE EAR AND UPPER RESPIRATORY TRACT. DR. SIEMENS.

This paper appeared in the *Zeitschrift für Hals-, Nasen- und Ohrenheilkunde* (**29**:3 [May 5] 1931) and was abstracted in the ARCHIVES (**14**:381 [Sept.] 1931).

CONSTITUTIONAL PROBLEMS IN THE PATHOGENESIS OF DISEASES OF THE THROAT, NOSE AND EAR. DR. ALBRECHT.

This paper appeared in the *Zeitschrift für Hals-, Nasen- und Ohrenheilkunde* (**29**:18 [May 5] 1931) and was abstracted in the ARCHIVES (**14**:389 [Sept.] 1931).

THE INDIVIDUAL CONDITIONS OF THE MUCOSA OF THE MIDDLE EAR IN ITS DEVELOPMENT AND STRUCTURE. DR. SCHWARTZ.

Histologic investigations were made of the temporal bones of fetuses from 3 to 10 months of age. The embryonal mucosa consisted of homogeneous loosely fibrillar connective tissue. From case to case there was considerable difference in the thickness of the tunica propria and in the structure. In the same fetus there was no difference in the two sides. According to Schwartz' view the causes of variation are individual developmental tendencies of the fibroblasts, shown in individual fibril growth tendencies. Excellent illustrations are included.

CONSTITUTION AND THE MIDDLE EAR MUCOSA. DR. MEYER.

An attempt was made to determine, in preparations from human beings and from monkeys, which changes were due to inflammation and which to constitutional factors. The relations between epithelium and submucosa with reference to pneumatization are discussed, Meyer's point of view being that the epithelium is the active, and the submucosa the passive agent.

PNEUMATIZATION OF THE MASTOID PROCESS. DR. STEURER.

According to the investigations of Albrecht and Schwartz the idiotypic constitution of the middle ear mucosa plays an important rôle in the pneumatization of the mastoid. One must also accept, according to the investigations of Wagener, the theory that the reaction of the bone of the mastoid to the pneumatization efforts of the middle ear mucosa varies with the individual (i. e., it is genotypic). Therefore scant or absent cell structure in the mastoid is regarded as a constitutional anomaly. This explanation is plausible when the mastoids are about alike. When there is a considerable difference in structure this explanation does not suffice, for the following reasons: 1. The idiotypic nature of the mucosa in the same person cannot be very different in the two ears. 2. The same is true of the mastoid spongiosa. 3. Differences in the size of the mastoids and in the extent and arrangement of the spongy bone cannot explain wide differences in the two sides in the same person. Asymmetry does occur within certain limits. As a rule there is marked symmetry when one includes not only the pneumatized portion but also the nonpneumatized part of the spongiosa. Sections and roentgenograms show that sometimes in mastoids that are outwardly alike, one side may be well pneu-

matized and the other not. In such cases the only explanation is environmental influence (otitis in the nursling?).

DISCUSSION

DR. LEICHER: In a case observed in identical twins, one had otitis and the other did not. The healthy one showed good pneumatization, whereas the other did not, indicating the extent of environmental influence.

THE EAR OF A CHONDRODYSTROPHIC DWARF. DR. RUTTIN.

The enchondral portion of the capsule of the labyrinth showed no changes. The periosteal labyrinth capsule was hypoplastic. This was best seen over the sagittal canals where the periosteal capsule reached in places to the dura. The facts that the growth of the enchondral portion of the capsule ceases in the second year and that the chondrodystrophy begins later or lasts over a long period explain why no changes appeared in the enchondral portion. The article is well illustrated.

OSTEOMALACIA OF THE TEMPORAL BONE. DR. KRAINZ.

Osteomalacia is a general disease characterized by scanty calcification of newly formed bone, namely, the functionally active portions of the skeleton. In connection with circulatory disturbances it is regularly associated with osteitis fibrosa. Changes indicative of osteomalacia were found in five specimens of temporal bone, especially in the carotid canal, roof of the pyramid and antrum and the wall of the sigmoid sinus, associated with fibroid changes in the marrow. Its occurrence is connected with functional disturbance of the blood stream. It the pneumatized mastoid those parts in particular showed changes which served to brace the cortex against the pull of the sternocleidomastoid muscle.

BACTERIOLOGY, PATHOGENESIS AND THERAPY OF OTITIS COMPLICATING SCARLET FEVER, WITH REFERENCE TO CONSTITUTIONAL FACTORS. DR. SEIFERTH.

Ninety per cent of 69 cases of otitis complicating scarlet fever showed hemolytic streptococci in the discharge. In the remaining 10 per cent the bacteriologic entities were harmless and the condition healed without operation. The cases of necrosis, all the operative cases and those with intracranial complications were included in the 90 per cent. One should not, however, draw the conclusion that otitides yielding a hemolytic streptococcus have a causal relationship to scarlet fever, as this organism is the most frequent and virulent in all otitides.

Most important for the pathogenesis is the immunity status during scarlet fever. According to Fanconi's investigations of the blood the immunity status fluctuates periodically during the disease. There is a change from a positive to a negative phase underlying the onset of otitis just as in other complications.

Among the constitutional factors the exudative diathesis plays a most important rôle. These patients are predisposed to middle ear disease by their frequent nasopharyngeal infections. Of great significance is the lymphatic component of the exudative diathesis, as the lymphatic system appears to be very susceptible to the scarlet fever toxin. The pathogenetic result of the lymphatic constitution consists, aside from the lymphatic pharyngeal ring, principally in the tubal tonsil. The vagotonic and neurotic components of the exudative diathesis are an influence in early otitis (at the beginning of scarlet fever), as they cause capillary damage to the middle ear mucosa.

The indications for the mastoid operation have the same basis as genuine otitis. In the necrosing form it is important to open the mastoid at the right time to avoid greater destruction by the rapidly advancing process and also to preserve the hearing. When there is sequestration an operation must be performed; to await spontaneous separation is dangerous, as a further spread of the reaction may cause meningitis. In the severe cases in this study the general condition was never influenced unfavorably by the operation. As far as possible, all patients were operated on under local anesthesia. Healing occurred in nearly 100 per cent.

DISCUSSION

DR. HIRSCH: I have frequently found the Mandelbaum bacillus in cases of scarlet fever complicated by otitis.

DR. HUENERMANN: I have seen 2,800 cases of scarlet fever in the last four years; 359 cases were complicated by otitis; in 8 per cent an antrotomy was performed and in two cases a radical operation. There were 1.41 per cent fatalities. In prolonged cases caused by adenoids the latter should be removed, under proper precautions.

DR. GOLDMANN: I have observed an epidemic associated principally with disease of the nasal accessory sinuses.

DR. FRENTZEL: I recommend adenoidectomy in the fourth or fifth week in cases of a protracted discharge without mastoiditis.

DR. HALLE: In all protracted cases of otitis I recommend adenoidectomy before antrotomy. In many cases there is rapid healing without antrotomy.

ANATOMIC CONDITIONS AS CONSTITUTIONAL FACTORS IN THE OCCURRENCE OF OTOGENIC GRAVITY ABSCESSES. DR. KREPUSKA.

This well illustrated article shows temporal bones of varying anatomic construction, indicating the part that this variation plays in the occurrence of the different types of gravity abscesses. Dr. Krepuska differentiates 11 groups: abscessus retro-auricularis, preauricularis, dissecans coli, suboccipitalis, prejugularis, prevertebralis, perivertebralis, retropharyngealis; submandibularis, dissecans antelateralis and mediastinitis posterior. Subdural and perisinus abscesses are not included, as they are considered intracranial. The etiology, symptomatology and treatment are described.

DISCUSSION

DR. GOERKE: According to the ideas expressed, therapy has no influence, as constitutional factors decide the definite course perforce.

THE RELATION OF MÉNIÈRE'S DISEASE TO THE ALLERGIC DISPOSITION AND TO OTHER IRRITATIONS OF THE VEGETATIVE NERVOUS SYSTEM. DR. VOGEL.

Of 83 patients with an essential Ménière complex, 5 had hay fever; 9, urticaria; 15, nonallergic vasomotor rhinitis; 5, asthma; 14, cholangeitis and cholecystitis; 4, stomach ulcer, and 3, epilepsy. Half of the patients showed one or more vegetative symptoms. Ménière's disease is not classified among the allergic diseases, but frequently occurs in irritative conditions of the vegetative nervous system. A familial occurrence appears to be infrequent.

ARTHRITISM AND DISEASES OF THE EAR, NOSE AND THROAT. DR. LEICHER.

The empiric clinical picture called arthritism, in no way a clinical entity, finds its cause and manifestation in a hereditary constitutional tendency that one must accept as a fact to explain how certain diseases, such as gout, diabetes, obesity, gallstones, kidney stones, premature atherosclerosis, rheumatism and chronic arthritic processes, as well as allergic diseases (asthma, urticaria, colitis membranacea, eczema and migraine), on the one hand occur in the same person at the same time, or consecutively, and on the other hand occur frequently in members of the same family. This raises the question: How can these clinically different diseases be classed under one name? Are they characterized by any common pathophysiologic syndrome? Spiro showed in many investigations that all the diseases of this group except stone formation have three symptoms in common: eosinophilia, hypercalcemia and a hyperkinetic blood sugar curve. (When 100 Gm. of dextrose is given to persons in the fasting condition, the normal increase in a half hour is from 50 to 75 per cent, with a return to the fasting level in two hours. In arthritism the figure is over 100 per cent.) This symptom triad can be found in allergic rhinitis (also in the form that is not due to pollen), in allergic bronchitis, in certain forms of eighth nerve crises, in hyperacusis endogenica and in some cases of presbycusis and otosclerosis.

THE CONSTITUTIONAL CAUSATION OF OUTSTANDING AURICLES. DR. RICHTER.

Outstanding auricles are associated with other deformities of the auricle, with signs of constitutional inferiority and with large adenoids.

THE PROBLEM OF FATIGUE IN ITS SIGNIFICANCE FOR THE PATHOLOGY OF THE VOICE, WITH SPECIAL REFERENCE TO CONSTITUTIONAL ANOMALIES OF THE UPPER RESPIRATORY PASSAGES. DR. STERN.

Fatigue plays an important rôle in pathologic conditions of the voice through a lack of the finer adjustment between agonist and antagonist muscles and a failure of control on the part of the sensory end-organs, resulting in the accumulation of fatigue poisons in the larynx, especially in those cases in which the larynx is constitutionally inferior. These anomalies are not limited to the larynx, but exist in other parts of the airway (enlarged posterior ends of the conchae, etc.). Dr. Stern is concerned with functional ability and the question of measuring fatigue. Through kinematographic tracings of respiratory movements in a singer during fatigue as compared with tracings in the same person under normal conditions, deviations from the norm in varying curves, loss of the normal asynchronism between thoracic and abdominal speech and singing voice, may be discovered and serve as criteria for a causal therapy.

EXPERIMENTAL DETERMINATION OF THE DEVIATION OF THE CUPOLA TERMINALIS IN THE INTACT AMPULLA OF THE LABYRINTH BY CALORIC AND ROTATION STIMULATION. DR. STEINHAUSEN.

The ampulla (of a pike) was freed, and a hole was burned into the canal wall with a microthermocautery. A little india ink was put into the canal and allowed to run into the ampulla and stain the cupola. The opening was closed with a barberry thorn. The cupola was observed through the intact ampulla, and its deviation under caloric and rotation stimulation was noted and photographed. Under the caloric test the deviation lasts a long time and is sometimes considerable. Under the rotation test it consists of short quick movements. The experiment supports the Mach-Breuer theory. Diapositive and stereoscopic pictures were shown.

THE INFLUENCE OF CENTRAL NERVOUS FACTORS IN SOME VESTIBULAR REACTIONS. DR. FISCHER.

After irrigation of both ears with the same quantity of water at the same temperature under certain conditions, so-called pulsion reflexes were elicited. If these irrigations were repeated at ten minute intervals with higher or lower temperatures, their effect diminished until it entirely disappeared. At moderate temperatures there was a characteristic change in the duration and direction of the pulsion reflex. Further tests were made in which after one irrigation another was given ten, twenty, thirty or more minutes later and the effect observed. It was found that the duration and direction of the pulsion reflex were determined by the time interval. Disturbances in temperature and reactions of blood vessels could be excluded. The condition is one of changes in the central nervous reflex centers brought about by the stimulation. From these tests Dr. Fischer concludes that the caloric reflexes are not influenced by conditions in the reception apparatus alone, as was also determined by Lorente de No.

INTERESTING CLINICAL AND HISTOLOGIC OBSERVATIONS IN DISEASE OF THE EAR IN DIABETES. DR. VOSS.

The following cases were described: 1. Clinically a patient showed otitis externa circumscripta and media duplex. He died in coma. Histologic examination revealed otitis media with organization and genuine neuro-epithelial degeneration.

2. The clinical report showed mucous otitis, with profuse serous secretion (traumatic?) for one week. The patient died in coma. Histologic study revealed acute otitis media, with organization changes but no trace of a lesion in the temporal bone, and mild sinus thrombosis.

3. Clinically a case showed subacute (mucosus) otitis media of three months' duration, labyrinthitis purulenta and meningitis, ending in death. No histologic examination was made.

4. Clinical observations were acute (mucosus) otitis media of unknown duration, labyrinthitis and death from fulminant meningitis. Histologic examination showed invasion through the ringband and labyrinthitis purulenta hemorrhagica diffusa.

5. Clinically a case showed acute otitis media and mastoiditis. An antrotomy was performed. After several weeks the patient died of meningitis. Histologic examination revealed severe acute otitis media purulenta. The internal ear was normal. The point of invasion was not found.

6. Clinical examination showed acute (mucosus) otitis media and mastoiditis. An operation was not performed on account of the patient's poor general condition. Death occurred from meningitis. Histologic study revealed acute otitis media and mastoiditis, a wide area of pneumatization, purulent pyramid tip cells and rupture through the carotid canal.

7. Clinically there was acute exacerbation of a chronic suppurative otitis media on the right, with symptoms of a fistula; following a radical operation, normal healing took place. For a year the patient had severe trigeminal neuralgia and then total deafness; the labyrinthine reaction was lost; paresis of all three branches of the facial nerve was noted, and a large parapharyngeal abscess developed with widespread bone necrosis of the entire pyramid. After progressive somnolence and loss of strength the patient died. Autopsy was not performed.

Treatment for Diseases of the Ear in Diabetes. Dr. Hirsch.

The teaching before the use of insulin, as well as Dr. Hirsch's own experience, was that furunculosis or otitis media in a patient with diabetes is a serious complication. Therefore in every case of disease of the ear and diabetes Dr. Hirsch uses insulin together with an appropriate diet to get the patient sugar-free. Since mild diabetes may become dangerous after operative procedures, the prophylactic use of insulin is in order. If suppuration of the middle ear does not heal under insulin therapy, operative measures should be instituted. A mastoid operation in a diabetic patient while he is under treatment with insulin is less dangerous than delay. Dr. Hirsch reports some cases.

Hearing Induced by Electrostatic Sound Waves Through the Body. Dr. Kahler and Dr. Ruf.

Tone frequencies produced by electrical energy, under definite control, were applied to the body. It was found that everywhere in the skin they were transmuted into acoustic mechanical waves. These were heard not only by the person experimented on but also by others nearby but not in the electrical circuit. How the deaf ear perceives these vibrations is demonstrated by sensation unit curves. In the tests, hearing was not brought about by direct stimulation of the nervus cochlearis. On the other hand, acoustic mechanical vibrations were heard by the usual air conduction. These vibrations were also heard when the air conduction was shut off, that is, in conduction deafness. The sound seemed to be conducted by the cranial bones. Conduction deafness failed to increase the bone conduction to any degree. This fact and numerous other experiments indicate with great probability that the hearing of electrical vibrations takes place by acoustic mechanical transmutation of these waves in the organ of hearing itself through changes of potential.

ROENTGENOLOGIC INVESTIGATION OF THE MASTOID PROCESS AFTER RESOLVED OTITIS. DR. KRIEGSMAN.

Roentgen investigations of pneumatization were made in persons who had had otitis during their early years. Perforating otitis in the first two years (one attack) caused no inhibition of pneumatization. Frequent mild, mostly nonperforative, otitides showed complete or high grade inhibition of pneumatization. There seems to be a connection between a tendency toward otitis and lack of pneumatization.

DISCUSSION

DR. FREMEL: One third of the patients who underwent an antrotomy subsequently showed good pneumatization of the mastoid.

THE SIGNIFICANCE OF ROENTGENOGRAMS OF THE TEMPORAL BONE IN BASAL FRACTURES, ACCORDING TO THE TECHNIC OF SCHUELLER, STENVERS AND E. G. MEYER. DR. BLOHMKE.

The indications for operation in injuries of the aural region of the base of the skull are as yet in dispute because of the lack of definitely reliable results from both general and special methods of examination. The usual roentgenologic technic especially has failed to yield reliable information as to the presence and direction of basal fracture. The technic of Schueller, Stenvers and E. G. Meyer, however, gives absolutely reliable objective evidence of basal fracture. It is to be hoped that more reliable indications for an operative procedure as well as the determination of questionable injuries after long-standing fracture will be brought about. Typical pictures with clinical application were shown.

DISCUSSION

The discussion showed no consensus among the roentgenologists. Many favored stereoroentgenograms. Dr. Uffenorde lays the plate at the back of the neck and depresses the chin. This position gives a good view.

DISEASES OF THE ACCESSORY SINUSES AND THE MIDDLE CRANIAL FOSSA IN AXIAL ROENTGENOGRAMS. DR. MITTERMEIER.

With a simple cassette to which the Bucky diaphragm is attached in such a manner that it is freely movable in a horizontal axis, it is possible to obtain good pictures of the skull in the axial direction. These pictures give an excellent view of the topographic relations of the posterior accessory sinuses. They are especially useful for the demonstration of diseases of the sphenoid and ethmoid sinuses, hypertrophy of the posterior ends of the conchae, malignant tumor of the antrum, etc. They also give diagnostically reliable views of processes in the middle cranial fossa which have led to destruction of bone at the base of the skull.

PATHOLOGIC ANATOMY OF OTOGENIC FACIAL PARALYSIS. DR. VERMES.

The author demonstrated microscopic sections from four cases. He also described the cases clinically.

THE ANATOMY OF DOUBLE CONGENITAL CHOANAL ATRESIA. DR. ALTMAN.

Dr. Altman presented diapositives and a wax model of the anatomic conditions in a case of double choanal atresia, examined in serial sections. The case occurred in a premature infant of 7 months, who also had double atresia of the external auditory canal and aplasia of the mandible and zygoma.

PATHOGENESIS OF CHOANAL ATRESIA. DR. STUPKA.

There are many points of view and dissertations on the genesis of choanal atresia. The anomaly is mostly looked on as one of excessive growth. Stupka

demonstrated histologic serial sections from a case of arhinencephalia with a partial defect of the middle nasal process, in which the nose was closed off from the mouth and from the normal epipharynx by massive bony tissue. This closure was in the same location as typical choanal bony atresia, and developed from the same material, namely, the first gingival process of the embryonal maxillary process, i. e., the first branchial arch. These signs indicated that a complex inhibition of development existed owing to lessening of the growth energy of the olfactory sac. (The article is well illustrated.)

DISCUSSION

DR. UFFENORDE: In a case of atresia I observed, on the narrow side, well developed sinuses with a normal mucosa.

DR. STUPKA: Only one patient was examined post mortem who showed very narrow antrums.

OTOSCLEROSIS IN POLARIZED LIGHT. DR. WEBER (by invitation).

Polarized light has been utilized for some time in normal histology for analysis of the finer structures, but not for the pathologico-anatomic substratum in otosclerosis. Ten cases in various stages of development were shown by lantern slides. The arrangement, course and grouping of the fibrils on the border and within the otosclerotic areas were demonstrated. Like fields of the same preparations stained with hematoxylin-eosin were also shown. By a combination of both methods it was possible to show clearly all three elements of the bone (cells, matrix and fibrils). From this it appears that otosclerosis must be looked on as a new growth after previous resorption. In spite of this regrowth it is impossible to show any matrix lines in hematoxylin-eosin preparations. From these observations a question is raised as to the visibility of the matrix lines in otosclerosis.

DISCUSSION

DR. MEYER: The intensity of the coloring of the bone is dependent on the amount of retained matrix.

DR. LANGE: I think that the method is suitable for judging the growth of the labyrinthine capsule but not the relations between old and new bone.

BACTERIOLOGY OF CHRONIC SUPPURATIVE OTITIS MEDIA. DR. HESSE.

One hundred and fifty patients with chronic suppurative otitis media were examined for both aerobic and anaerobic invaders; especially those cases showing complications were investigated. Most of them showed polybacterial infection. It is probable that the course of the disease as well as the complications is determined by the nature of the infection. In complicated cases of chronic suppuration streptococci were noticeably frequent in the pus in acute exacerbation. In complicated cases Proteus infection was frequent. Equally divided between complicated and uncomplicated cases were staphylococci, the pseudodiphtheria bacillus, Bacillus coli, the pneumococcus and Friedländer's bacillus.

ROTATION TESTS. DR. VEITS.

The usual test of ten turns in twenty seconds is not beyond criticism, as it is not a single but a double stimulation; i. e., there is interference between two stimuli. After twenty seconds the central phase caused by the rotation is still functioning, while a new stimulus is applied by the stopping. In order to produce a single stimulus the following technic is advised: slow turning until the maximum of one turn in two seconds is reached, even continuance of the turning until all sensation has disappeared, and then sudden stopping and counting of the nystagmic movements. By this method the variations are one-half those found after ten turns and the nystagmus is more rhythmic. Usually the after-nystagmus can be observed, which is unusual after the ordinary technic.

DISCUSSION

DR. RUTTIN: I think the finer technic to be of no practical advantage. The old methods are sufficient for operative indications.

DR. VEITS: The caloric tests alone are sufficient for ordinary practice.

THE VESTIBULAR APPARATUS AND SPIROMETRY. DR. TAMARI and DR. EXNER.

The spirometric curve was tested after caloric and galvanic stimulation of the labyrinth; also after the fistula test. The spirometer curve, taken on a registered instrument, is regarded as an index of oxygen consumption. The following conclusions were arrived at: 1. The tests described cause a typical lessening of oxygen consumption. 2. Irritation of an excluded labyrinth causes no such reaction. 3. Together with the sinking of the spirometric curve there is a transient bradycardia.

DISCUSSION

DR. RHESE: (Dr. Rhese called attention to the anatomic relation between the dorsal vagus nucleus and vestibular nuclei and to his own observations of the influence of the labyrinthine reaction on the respiration and pulse.)

DR. BECK: There is possibly a psychic influence that alone can cause the respiratory and cardiac symptoms.

DR. TAMARI: I believe that the phenomenon described cannot be explained by influence on the vagus alone. In regard to a psychic influence, I have shown that the reflex can be entirely inhibited in some persons. However, the graphs show that the loss of oxygen consumption is sudden and of short duration and may reach 40 per cent of the normal rate.

A GRAPHIC HEMOGRAM AFTER A NEW PRINCIPLE: ITS APPLICATION IN OTITIS MEDIA. DR. SCHWARZBART.

A new graphic chart is presented in which the percentages of the various types of cells are carried across at the varying total counts. Two smaller rectangles show the "Verschiebung" and the leukocyte index. Eight illustrations of various cases with and without complications are shown.

THE SYMPTOMATOLOGY OF GUMMA OF THE SEPTUM. DR. GOLDMANN.

The subjective symptoms are not characteristic, but the symptom of loss of sensibility of the upper incisors for touch and pressure is. This is due to the cutting off of impulses along the nervus nasopalatinus from the sphenopalatine ganglion through the septal mucosa, which, together with the nervus palatinus anterior, supplies sensation.

THE ROENTGEN DIAGNOSIS OF MAXILLARY CYST. DR. GOLDMANN.

Dr. Goldmann recommends contrast filling, through the fistula if one is present; if there is none, puncture and drainage should be employed, followed by contrast filling. He differentiates a maxillary cyst from tumor or granuloma.

ROENTGENOTHERAPY OF THE LYMPHATIC PHARYNGEAL RING IN CHILDREN. DR. ESCH.

Roentgenotherapy was used in 101 children; 96 were reexamined after half a year. Thirty were clinically well and 48 uninfluenced; partial success was achieved in 18. Before treatment 48 were subject to sore throat with fever; 26 of these were well and 22 uninfluenced. Seventy-one had constant rhinitis; in 32 the condition had healed; 36 were uninfluenced; there was obstructed nasal respiration in 91; 26 had free breathing and 65 were made worse, the adenoid being the source of obstruction. In no case was there a definite regression of the tonsils or adenoids.

The clinical result appeared to be a lessening of the infectious element. There were no complications, and histologic examination showed no pathologic changes of either the lymphoid or the connective tissue.

DISCUSSION

DR. HALLE: Injurious results may appear after two years; there may be a dry throat and even a malignant growth. Patients with cervical adenitis are never helped. Roentgenotherapy should be reserved for neuropathic patients.

DR. THIELMAN: It should be used only as a last resort.

DR. MARSCHIK: Definite indications for roentgenotherapy should first be established. Mucosal injury is to be expected. Irradiation has not proved successful in chronic tonsillitis, but diffuse damage to the lymph follicles of the mucosa has been noted.

DR. GOLDMANN: I have had successful results in cases of tonsillitis.

DR. CEMACH: In 40 patients whom I treated the end-result was good in 3 or 4. After two years the tonsillitis was worse.

DR. HIRSCH: I have observed a persistent dry catarrh, and in one case severe bleeding occurred at a subsequent tonsillectomy.

DR. ECKERT-MÖBIUS: I should advise caution. The experience of American observers shows new troubles added to the old. We do not know what will happen to the immature mucosa in five or ten years. Atrophic changes have already been noted.

DR. MUELLER: In Bad Kreuznach I saw regression of the adenoids after sun therapy.

DR. BUETTNER: I saw a second severe attack of diphtheria occur in a carrier after irradiation.

THE NECESSITY FOR A CLEAR DEFINITION OF THE TERM "POSTANGINEOUS SEPSIS." DR. KRUEGER.

To make the diagnosis exact, Dr. Krueger states that the infecting organism should be identified. The presence of anaerobic streptococci indicates a poor prognosis; the presence of the hemolytic streptococcus is not so unfavorable, and that of Streptococcus viridans is comparatively favorable. It has also been noted that these organisms have a predilection for certain tissues in metastases: the anaerobes, almost without exception, for the lung, rarely for the bone, the hemolytic streptococcus for the serosa and musculature and Streptococcus viridans, for all tissues without destruction.

THE PRESENT POINT OF VIEW CONCERNING SEVERE PYEMIA FOLLOWING ANGINA: OBSERVATIONS IN ONE HUNDRED CASES. DR. CLAUS.

Definition.—Under this head, Dr. Claus includes only such cases as show thrombosis, or at least changes in the walls of the vessels (phlebitis). The latter indicate a small retrotonsillar thrombophlebitis, perhaps too small for macroscopic observation. Often metastases have already formed. Cases that clear up after tonsillectomy alone do not belong in this class.

Symptoms.—These are: marked prostration; a cyanotic-icteric color; a small, rapid, soft pulse; a dry tongue, and tenderness under the angle of the jaw on the affected side, even though there is no infiltration (in cases of adenitis this symptom is not reliable, as it may be due to the adenitis). Chills may be absent. Fever may be intermittent or continuously high. If there are still local signs on the tonsils, the blood picture is essential for the differential diagnosis of lymphoid cell angina, agranulocytosis and acute leukemia. If the angina has occurred some time before, other diseases that show elevation of temperature most be excluded (typhoid, pneumonia, erysipelas, pyelonephritis and malaria).

Therapy.—In severe cases exposure of the veins of the neck to the clavicle is recommended, with investigation of all jugular tributaries from above the facialis; the ligatures should be placed as high and as low as possible. Tonsillectomy is made dependent on the general condition and on the finding of a phlegmon along the facialis posterior. If one is found extending to the tonsillar bed, the operation is omitted.

Pathogenesis.—Histologic examination in 21 cases showed a leukocytic, perivascular infiltration in the retrotonsillar tissues, i. e., an inflammation of a phlegmonous nature. This approaches Uffenorde's idea, but Dr. Claus thinks that the inflammation is not primarily lymphatic, but goes from the connective tissue to the lymph and blood vessels. He does not believe in a pure primary thrombophlebitis (Fraenkl). The results are better the earlier the cases are recognized.

SECTION IN SEPTICOPYEMIA AFTER ANGINA, WITH COMMENTS ON THE PATHOGENESIS. DR. ANDERS.

The usual Virchow method is inadequate as it does not carefully preserve the venous outflow from the tonsillar region. The Christeller incision with a special topographic dissection was used. One incision discloses the tonsil, tonsillar bed and parapharyngeal space with the veins. Usually the atrium in the tonsil does not show acute inflammatory changes either macroscopically or microscopically. On the other hand, in the peritonsillar tissues there are well defined abscesses or phlegmonous processes that extend to the venous branches. Thrombophlebitis as a primary factor, in the sense of E. Frankel's observation, was not observed in any case. In all cases the regional lymph vessels and the jugular lymph glands showed an abscess process. The flooding of the upper veins with bacteria results, in the majority of cases of sepsis leading to pulmonary abscesses, or if the invasion is subpleural, to pleural necrosis and empyema. This is the cause of death in many cases without the infection getting into the general circulation. Besides the local extensions (mediastinitis and meningitis) the metastases found were the nephritides, osteomyelitis, prostatitis, ulcerative endocarditis, etc.

DISCUSSION

DR. UFFENORDE: I agree with Dr. Claus that not tonsillectomy but exposure of the veins is the most important procedure. A tonsillectomy may be performed later so as not to disturb nourishment. Sometimes venous exposure, sometimes tonsillectomy alone and sometimes both procedures separately should be undertaken.

DR. HIRSCH: I agree with Dr. Anders. I observed a case of agranulocytosis that cleared up after double jugular ligation, without preliminary irradiation.

DR. LEICHER: To prevent mediastinitis I use continuous suction for three or four days.

DR. VOSS: One should not await the results of cultivation of the blood, but should proceed to expose the veins on clinical indications. Whenever possible, the tonsillectomy should be postponed to allow nourishment to be taken.

DR. RUTTIN: It is difficult in the presence of otitis media to determine whether the sepsis is anginal or otitic. Usually in such cases it is otitic.

DR. SCHWARTZBART: Many patients with fever, trismus and threatening mediastinitis following tonsillectomy recover without operation.

DR. KRUEGER: *I do not believe that staphylococci are pathogenic in the* tonsils. I suggest that the patient with agranulocytosis recovered despite ligation.

DR. CLAUS: The cases described of cervical adenitis with fever had nothing to do with postanginous pyemia. In the real cases described (showing prostration, a dry tongue, a small, thin pulse and tenderness under the maxillary angle), the patient must be operated on promptly. The condition does not heal after tonsillectomy. The important thing is the wide exposure of the veins. The internal jugular vein is ligated to prevent extension of the phlegmon. When the phlegmon extends to the tonsillar bed and can be reached for drainage, tonsil-

lectomy may be dispensed with. I had a case in which all the veins were found to be intact and the ear had to be operated on, as suggested by Ruttin; recovery took place. The patient with severe postanginous pyemia does not recover without operation.

A New Method of Heliotherapy for Laryngeal Tuberculosis. Dr. Cemach.

The new apparatus is a water-cooled quartz lamp with the lighting element in the tip of a laryngeal curve, and so can be applied in any position, even upside down; the tip may also be used for compression. The application is easy and comfortable, and can be interrupted at short intervals if desired. Superficial ulcers heal readily; infiltrations require months of treatment; connective tissue may never entirely disappear; cornified excrescences require operation, preferably with the flat cautery, while the infiltrations are better treated by the puncture cautery. In the present status of heliotherapy, laryngeal tuberculosis is no longer of unfavorable prognosis under certain conditions. Cure may be expected only in cases in which the general condition permits it. There must be a sufficient local reaction present; it is this and not the light that clears up the condition. The economic condition of the patient must permit proper care and nourishment; the local treatment must be supplemented by appropriate general treatment, which is fundamental.

The Constitutional Factor in the So-Called Spontaneous Radical Operation. Dr. Amersbach and Dr. Kraus.

Roentgen studies were made of 2,000 cases among which there were 18 instances of breaking through into the external canal; 8 of these cases were bilateral. Of especial interest in the latter condition were the symmetrical findings and the type of patient. In the 8 bilateral cases the patients were asthenic and showed many signs of degeneration, including defects in intelligence. An effort was made to classify the roentgen observations.

Typical Occupational Injuries and Constitutional Predisposition. Dr. Mauthner.

After years of observation of laborers in the Ostrau-Karniver coal district, Dr. Mauthner has come to the conclusion that ears of constitutional inferiority react early to noise and concussion with progressive inner ear deafness (on an otosclerotic picture). The normal ear reacts after many years with a typical partial injury, affecting perception of high tones. This question should be investigated before the selection of an occupation.

Book Reviews

A Radiological Study of the Para-Nasal Sinuses and Mastoids. By Amédée Granger. Price, $5.50. Pp. 186, with 113 illustrations. Philadelphia: Lea & Febiger, 1932.

The author reviews many of the accepted angles of projection found useful in technic, laying particular stress on his own 107 degree angle view for sphenoids. Through this view the superior portion of the sphenoid sinus is brought to view without structural overlaps. Inferences are based mainly on the physical characteristics of the superior sphenoid walls, which are referred to as the "Granger line." The author compares the accuracy of inferences obtained by his sphenoid method with that obtained by the technic recommended by other writers. The observations by the author, while not widely accepted by roentgenologists and otolaryngologists, serve to furnish one additional method for the examination of the most obscure of the paranasal sinuses. The book emphasizes particularly a number of angles of projection to be used rather than the technical points that might contribute to the readable quality of the films. The illustrations show intensifying screen technic without the use of grid diaphragms.

News and Comment

AMERICAN BOARD OF OTOLARYNGOLOGY

The American Board of Otolaryngology will hold an examination, Saturday, September 17, at the Royal Victoria Hospital, Montreal. Application blanks may be had from the Secretary, Dr. W. P. Wherry, 1500 Medical Arts Building, Omaha.

Directory of Otolaryngologic Soci[illegible]

NATIONAL

American Medical Association, Section on La[illegible]ay, Otology and Rhinology

Chairman: Dr. Gabriel Tucker, Bronchoscopic Clinic, Hospit[illegible] University of Pennsylvania, Philadelphia.
Secretary: Dr. John J. Shea, 1018 Madison Ave., Memphis, [illegible]
Place: New Orleans. Time: May 9-13, 1932.

American Academy of Ophthalmology and Ot[illegible]ology

President: Dr. S. Hanford McKee, 1528 Crescent St., Mont[illegible]nada.
President-Elect: Dr. B. R. Shurley, 62 W. Adams Ave., [illegible]
Executive Secretary: Dr. William P. Wherry, Medical A[illegible], Omaha.
Place: Montreal, Canada. Time: Sept. 19-23, 1932.

American Bronchoscopic Societ[illegible]

President: Dr. Louis H. Clerf, 128 S. Tenth St., Philadelp[illegible]
Secretary: Dr. Richmond McKinney, 899 Madison Ave., M[illegible]phis, Tenn.
Place: Atlantic City, N. J. Time: May 21, 1932.

American Laryngological Associati[illegible]

President: Dr. George E. Shambaugh, 122 S. Michigan Av[illegible], Chicago.
Secretary: Dr. George M. Coates, 1721 Pine St., Philadelp[illegible]a.
Place: Atlantic City, N. J. Time: May 19-21, 1932.

American Laryngological, Rhinological and Oto[illegible]gical Society

President: Dr. Max A. Goldstein, 3858 Westminster P[illegible]t. Louis.
Secretary: Dr. R. L. Loughran, 33 E. Sixty-Third St., [illegible]w York.
Place: Atlantic City, N. J. Time: May 23-25, 1932.

American Otological Socie[illegible]

President: Dr. L. W. Dean, Washington University, St. Lo[illegible]s.
Vice President: George L. Tobey, 270 Commonwealth Ave[illegible] Boston.
Secretary: Dr. Thomas J. Harris, 104 E. Fortieth St., N[illegible]w York.
Place: Atlantic City, N. J. Time: May 17-19, 1932.

New Zealand British Medical Association, [illegible]ar, Nose and Throat Section

Chairman: Dr. James Hardie Neil, Auckland.
Secretary: Dr. W. Gillies Borrie, Auckland.
Time: March 28, 1932.

SECTIONAL

Eastern New York Eye, Ear, Nose and T[illegible]oat Association

President: Dr. F. M. Sulzman, 1831 Fifth Ave., Tro[illegible]
Secretary-Treasurer: Dr. Arthur F. Holding, 142 W[illegible]ington Ave., Albany.
Time: Third Wednesday of October, November, M[illegible], April, May and June.

New England Otological and Laryngo[illegible]gical Society

President: Dr. Harry P. Cahill, 520 Commonwealth [illegible]ve., Boston.
Secretary-Treasurer: Dr. Lyman G. Richards, 319 [illegible]gwood Ave., Boston.

Pacific Coast Oto-Ophthalmolog[illegible]l Society

President: Dr. W. F. Hoffman, 317 Summit Ave., [illegible]ttle.
Secretary-Treasurer: Dr. J. Frank Friesen, 1208 R[illegible]velt Bldg., Los Angeles.
Place: Seattle: Time: June 30-July 2, 1932.

Puget Sound Academy of Ophthalmolog[illegible]nd Oto-Laryngology

President: Dr. John H. Harter, 1215 Fourth Ave., S[illegible]ttle.
Secretary-Treasurer: Dr. Francis A. Brugman, 806 [illegible]obl[illegible] Bldg., Seattle.
Time: 8 p. m., third Tuesday of each month, e[illegible]cept [illegible]uly and August.

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* Secretaries of societies are requested to furnish the information necessary to make this list complete and to keep it up to date.

SIOUX VALLEY EYE AND EAR ACADEMY

President: Dr. John B. Gregg, 101 S. Main Ave., Sioux Falls, S. D.
Secretary-Treasurer: Dr. Frederick H. Roost, 420 Trimble Bldg., Sioux City, Iowa.
Place: Sioux City, Iowa. Time: November, 1932.

SOUTHERN MEDICAL ASSOCIATION, SECTION ON EYE, EAR, NOSE AND THROAT

Chairman: Dr. Wiley R. Buffington, 211 Camp St., New Orleans.
Secretary: Dr. W. D. Gill, 323 Medical Arts Bldg., San Antonio, Texas.
Place: Birmingham, Ala. Time: November, 1932.

SOUTHWESTERN MICHIGAN TRIOLOGICAL SOCIETY

President: Dr. C. W. Ellis, 215 N. Walnut St., Lansing.
Secretary: Dr. H. B. Weinburgh, 301 Seymour St., Lansing.
Time: Third Thursday of alternate months.

STATE

COLORADO OTO-LARYNGOLOGICAL SOCIETY

President: Dr. F. J. Peirce, 511 N. Main St., Pueblo.
Secretary: Dr. Rex L. Murphy, Metropolitan Bldg., Denver.
Place: Assembly Room of Metropolitan Bldg. Time: First Saturday of each month from October to May.

CONNECTICUT STATE MEDICAL SOCIETY, SECTION ON EYE, EAR, NOSE AND THROAT

President: Dr. M. H. Merriman, 115 Prospect St., Waterbury.
Secretary-Treasurer: Dr. Walter L. Hogan, 750 Main St., Hartford.

EYE, EAR, NOSE AND THROAT CLUB OF GEORGIA

President: Dr. William L. McDougall, 50 Whitehall St., S. W., Atlanta.
Secretary-Treasurer: Dr. William O. Martin, Jr., 412 Medical Arts Bldg., Atlanta.

INDIANA ACADEMY OF OPHTHALMOLOGY AND OTO-LARYNGOLOGY

President: Dr. J. R. Gillum, 221 S. Sixth St., Terre Haute.
Secretary: Dr. J. Kent Leasure, 611 Hume-Mansur Bldg., Indianapolis.

IOWA ACADEMY OF OPHTHALMOLOGY AND OTO-LARYNGOLOGY

President: Dr. Royal French, 28 S. First Ave., Marshalltown.
Secretary-Treasurer: Dr. W. F. Boiler, 105 East Iowa Ave., Iowa City.

MICHIGAN STATE MEDICAL SOCIETY, SECTION OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

Chairman: Dr. Wilfred Haughey, 303 Post Bldg., Battle Creek.
Secretary: Dr. H. O. Westervelt, 239 Pipestone St., Benton Harbor.

MINNESOTA ACADEMY OF OPHTHALMOLOGY AND OTO-LARYNGOLOGY

President: Dr. Douglas Wood, 74 S. Ninth St., Minneapolis.
Secretary-Treasurer: Dr. W. E. Camp, Medical Arts Bldg., Minneapolis.
Time: Second Friday of each month, October to May.

MONTANA ACADEMY OF OTO-OPHTHALMOLOGY

President: Dr. L. H. Huber, Livingston.
Secretary: Dr. A. W. Morse, Phoenix Bldg., Butte.
Time: Semi-annually.

NEW YORK STATE MEDICAL SOCIETY, EYE, EAR, NOSE AND THROAT SECTION

Chairman: Dr. R. T. Atkins, 4 W. 53d St., New York.
Secretary: Dr. D. F. Gillette, 109 S. Warren St., Syracuse.
Place: Buffalo. Time: May 23-24, 1932.

NEW JERSEY STATE MEDICAL SOCIETY, SECTION ON OPHTHALMOLOGY, OTOLOGY AND RHINOLARYNGOLOGY

Chairman: Dr. H. L. Harley, 101 S. Indiana Ave., Atlantic City.
Secretary: Dr. B. E. Failing, 31 Lincoln Park, Newark.
Place: Atlantic City. Time: June 15-17, 1932.

NORTH DAKOTA ACADEMY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

President: Dr. F. L. Wicks, Valley City.
Secretary-Treasurer: Dr. W. L. Diven, National Bank Bldg., Bismarck.

OREGON ACADEMY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

President: Dr. H. M. Hendershott, 193 Eleventh St., Portland.
Secretary: Dr. Andrew J. Browning, 418 Mayer Bldg., Portland.
Place: Good Samaritan Hospital. Time: Third Tuesday of each month.

RHODE ISLAND OPHTHALMOLOGICAL AND OTOLOGICAL SOCIETY

President: Dr. Frank W. Dimmitt, 195 Thayer St., Providence.
Secretary: Dr. N. A. Bolotow, 108 Waterman St., Providence.
Place: Rhode Island Medical Library. Time: 8:30 p. m., second Thursday in October, December, February and April.

SOUTH CAROLINA MEDICAL ASSOCIATION, SECTION ON OPHTHALMOLOGY AND OTOLARYNGOLOGY

President: Dr. W. B. McWhorter, 106 E. Earle St., Anderson.
Secretary-Treasurer: Dr. G. M. Truluck, Orangeburg.
Time: April and December.

TEXAS OPHTHALMOLOGICAL AND OTO-LARYNGOLOGICAL SOCIETY

President: Dr. W. D. Jones, 3116 Live Oak St., Dallas.
Secretary: Dr. A. F. Clark, 1034 Nix Bldg., San Antonio.
Place: Fort Worth. Time: December, 1932.

UTAH OPHTHALMOLOGICAL SOCIETY

President: Dr. F. M. McHugh, 17 Exchange Pl., Salt Lake City.
Secretary-Treasurer: Dr. W. Leroy Smith, Erza Thompson Bldg., Salt Lake City.

VIRGINIA SOCIETY OF OTOLARYNGOLOGY AND OPHTHALMOLOGY

President: Dr. C. P. Jones, 3117 West Ave., Newport News.
Secretary-Treasurer: Dr. Henry Grant Preston, Harrisonburg.

WEST VIRGINIA STATE MEDICAL ASSOCIATION, EYE, EAR, NOSE AND THROAT SECTION

President: Dr. G. A. Smith, Montgomery.
Secretary: Dr. O. H. Bobbitt, Medical Arts Bldg., Charleston.

LOCAL

ACADEMY OF MEDICINE OF NORTHERN NEW JERSEY, SECTION ON EYE, EAR, NOSE AND THROAT

Chairman: Dr. Charles W. Buvinger, 50 Washington St., East Orange.
Secretary: Dr. Earl LeRoy Wood, 192 Roseville Ave., Newark.
Place: 91 Lincoln Park South. Time: 8:45 p. m., second Monday of each month.

ATLANTA ACADEMY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

President: Dr. W. L. McDougall, 50 Whitehall St., S.W., Atlanta, Ga.
Secretary: Dr. William O. Martin, Jr., 412 Medical Arts Bldg., Atlanta, Ga.
Place: Academy of Medicine, 38 Prescott St., N. E. Time: 8 p. m., last Thursday of each month.

Baltimore City Medical Society, Section on Otology and Laryngology

President: Dr. James J. Chisolm, Medical Arts Bldg., Baltimore.
Secretary: Dr. Louis Diener, 2449 Eutaw Pl., Baltimore.
Place: 1211 Cathedral St. Time: 8:30 p. m., last Friday of each month.

Buffalo Oto-Laryngological Society

President: Dr. John F. Healey, 925 Delaware Ave., Buffalo.
Secretary-Treasurer: Dr. Herrmann E. Bozer, 468 Delaware Ave., Buffalo.
Place: Buffalo Club. Time: Second Tuesday of each month from September to May, inclusive.

Chicago Laryngological and Otological Society

President: Dr. Howard C. Ballenger, 25 E. Washington St., Chicago.
Secretary-Treasurer: Dr. Austin A. Hayden, 25 E. Washington St., Chicago.
Place: Medical and Dental Arts Bldg., 185 N. Wabash Ave. Time: 6 p. m., first Monday of each month from October to May.

Cincinnati Oto-Laryngological Society

President: Dr. M. F. McCarthy, Union Central Bldg., Cincinnati.
President-Elect: Dr. Henry M. Goodyear, 19 Garfield Pl., Cincinnati.
Secretary-Treasurer: Dr. Samuel Seltz, Provident Bank Bldg., Cincinnati.
Place: University Club. Time: 6:45 p. m., second Tuesday of each month from October to May.

Cleveland Academy of Medicine, Section of Ophthalmology and Otolaryngology

Chairman: Dr. M. W. Jacoby, 2323 Prospect Ave., Cleveland.
Secretary: Dr. H. C. Rosenberger, 1065 Rose Bldg., Cleveland.
Place: Winton Hotel. Time: Fourth Friday of each month.
President: Dr. Edward D. King, 707 Race St., Cincinnati.

College of Physicians of Philadelphia, Section on Otolaryngology

Chairman: Dr. Ralph Butler, 2007 Chestnut St., Philadelphia.
Clerk: Dr. Karl M. Houser, 1826 Pine St., Philadelphia.
Place: College of Physicians. Time: 8:30 p. m., third Wednesday of each month from October to June.

Columbus Ophthalmological and Otolaryngological Society

Chairman: Dr. Ivor G. Clark, 188 E. State St., Columbus, Ohio.
Secretary-Treasurer: Dr. Francis W. Thomas, 327 E. State St., Columbus, Ohio.
Time: First Monday of each month.

Dallas Academy of Ophthalmology and Otolaryngology

President: Dr. L. M. Sellers, 1717 Pacific Ave., Dallas, Texas.
Secretary: Dr. W. Mood Knowles, 1717 Pacific Ave., Dallas, Texas.
Place: Dallas Athletic Club. Time: 6:30 p. m., first Tuesday of each month from October to June. The November, January and March meetings are devoted to clinical work.

Des Moines Academy of Ophthalmology and Otolaryngology

President: Dr. Cecil C. Jones, 1121 Equitable Bldg., Des Moines, Iowa.
Secretary-Treasurer: Grace Doane, 614 Bankers Trust Bldg., Des Moines, Iowa.
Time: Third Monday of each month, September to May, inclusive.

Detroit Oto-Laryngological Society

President: Dr. Raymond Goux, 1551 Woodward Ave., Detroit.
Secretary-Treasurer: Dr. R. Lee Laird, 513 David Whitney Bldg., Detroit.
Place: Maccabees Bldg. Time: Third Wednesday evening of each month from October to May.

Fort Worth Eye, Ear, Nose and Throat Society

President: Dr. R. H. Needham, 1304 Medical Arts Bldg., Fort Worth, Texas.
Secretary: Dr. Van D. Rathgeber, 1011 Medical Arts Bldg., Fort Worth, Texas.
Place: University Club. Time: 6:30 p. m., first Friday of each month except July and August.

Grand Rapids Eye, Ear, Nose and Throat Society

President: Dr. Carl F. Snapp, Medical Arts Bldg., Grand Rapids, Mich.
Secretary-Treasurer: Dr. Walter W. Oliver, 26 Sheldon Ave., Grand Rapids, Mich.
Place: Various local hospitals. Time: 6:30 p. m., third Thursday of alternating months, September to May.

Houston Academy of Medicine, Eye, Ear, Nose and Throat Section

President: Dr. L. W. Raney, 609 Fannin St., Houston, Texas.
Secretary: Dr. J. F. Gamble, 201 Main St., Houston, Texas.
Place: Medical Arts Bldg., Harris County Medical Society Rooms. Time: 8 p. m., first Thursday of each month from September to June.

Indianapolis Ophthalmological and Oto-Laryngological Society

President: Dr. B. J. Larkin, 23 E. Ohio St., Indianapolis.
Secretary: Dr. Kenneth L. Craft, 23 E. Ohio St., Indianapolis.
Place: Indianapolis Athletic Club. Time: 6:30 p. m., second Thursday of each month from October to May.

Kansas City Society of Ophthalmology and Otolaryngology

President: Dr. W. E. Keith, 1103 Grand Ave., Kansas City, Mo.
Secretary: Dr. O. S. Gilliland, Professional Bldg., Kansas City, Mo.
Time: Third Thursday of each month from September to May. The November, January and March meetings are devoted to clinical work.

Long Beach Eye, Ear, Nose and Throat Society

President: Dr. R. R. Montgomery, 102 Pine Ave., Long Beach, Calif.
Secretary-Treasurer: Dr. Russell T. Uhls, 823 Security Bldg., Long Beach, Calif.
Place: Pacific Coast Club. Time: Last Wednesday of each month from September to June.

Los Angeles County Medical Society, Section of Ophthalmology and Otolaryngology

President: Dr. J. Frank Friesen, 1208 Roosevelt Bldg., Los Angeles.
Secretary-Treasurer: Dr. F. H. Brandt, 1052 W. Sixth St., Los Angeles.
Place: Mary Louise Cafe. Time: 6:30 p. m., fourth Monday of each month, May to November, inclusive.

Medical Society of the County of Kings, Section on Otolaryngology

Chairman: Dr. Edward Leo Berger, 903 Park Pl., Brooklyn.
Secretary-Treasurer: Dr. Oscar Rodin, 893 Eastern Parkway, Brooklyn.
Place: Library Bldg., County Society, 1313 Bedford St., Brooklyn.
Time: 9 p. m., second Wednesday of January, March, May and November.

Medical Society of the District of Columbia, Section on Ophthalmology and Oto-Laryngology

Chairman: Dr. James A. Flynn, 1511 Rhode Island Ave., Washington.
Secretary: Dr. E. R. Gookin, Medical Science Bldg., Washington.
Place: 1718 M St., N. W. Time: 8 p. m., third Friday of each month.

Memphis Society of Ophthalmology and Oto-Laryngology

Chairman: Each member, in alphabetical order.
Secretary: Dr. R. O. Rychener, Exchange Bldg., Memphis, Tenn.
Place: Eye Clinic of Memphis Eye, Ear, Nose and Throat Hospital. Time: 8 p. m., second Tuesday of each month.

The Milwaukee Oto-Ophthalmic Society

President: Dr. T. F. McCormick, 324 E. Wisconsin Ave., Milwaukee.
Secretary-Treasurer: Dr. O. P. Schoofs, 324 E. Wisconsin Ave., Milwaukee.
Place: University Club. Time: 6:30 p. m., third Tuesday of each month.

Nashville Academy of Ophthalmology and Otolaryngology

Chairman: Dr. Hilliard Wood, 700 Church St., Nashville.
Secretary-Treasurer: Dr. H. C. Smith, Medical Bldg., Nashville.
Place: St. Thomas Hospital. Time: 8 p. m., third Monday of each month, October to June.

New Orleans Ophthalmological and Otological Society

President: Dr. Charles A. Bahn, 150 Baronne St., New Orleans.
Secretary-Treasurer: Dr. M. F. Meyer, Canal Bank Bldg., New Orleans.
Place: Eye, Ear, Nose and Throat Hospital. Time: January to June and October to January—third Thursday of each month.

New York Academy of Medicine, Section of Laryngology and Rhinology

Chairman: Dr. John M. Loré, 240 West End Ave., New York.
Secretary: Dr. Robert E. Buckley, 2 E. 103d St., New York.
Place: 103d St., and 5th Ave. Time: 8:30 p. m., fourth Wednesday of each month from October to May.

New York Academy of Medicine, Section of Otology

Chairman: Dr. Clarence H. Smith, 2 E. 54th St., New York.
Secretary: Dr. James Garfield Dwyer, 57 W. 57th St., New York.
Place: 103d St. and 5th Ave. Time: Second Friday of each month from October to May.

Omaha and Council Bluffs Ophthalmological and Otolaryngological Society

President: Dr. W. P. Haney, 107 S. 17th St., Omaha.
Vice President: Dr. L. G. Howard, 532, 1st Ave., Council Bluffs, Iowa.
Secretary-Treasurer: Dr. W. A. Cassidy, 1620 Medical Arts Bldg., Omaha.
Place: University Club, 1914 Harney St., Omaha. Time: Dinner, 6 p. m. Program, 7 p. m., third Wednesday of each month from October to May.

Philadelphia Laryngological Society

President: Dr. Arthur J. Wagers, 1429 Spruce St., Philadelphia.
Secretary: Dr. Herman B. Cohen, 1301 Spruce St., Philadelphia.
Place: College of Physicians. Time: 8:30 p. m., first Tuesday of each month from October to June.

Pittsburgh Otological Society

Chairman: Dr. James Homer McCready, 121 University Pl., Pittsburgh.
Secretary-Treasurer: Dr. Roy C. Cooper, 510 S. Aiken Ave., Pittsburgh.

Richmond Ophthalmological and Oto-Laryngological Society

President: Dr. Emanuel U. Wallerstein, Professional Bldg., Richmond, Va.
Secretary: Dr. William R. Weisiger, Medical Arts Bldg., Richmond, Va.
Place: Westmoreland Club. Time: 6 p. m., second Monday of each month from October to May.

Rochester Eye, Ear, Nose and Throat Society

Chairman: Dr. E. S. Amsler, 53 S. Fitzhugh St., Rochester, N. Y.
Secretary-Treasurer: Dr. E. W. O'Brien, 5 N. Goodman St., Rochester, N. Y.
Place: Rochester Medical Association, 13 Prince St. Time: 8 p. m., third Monday of each month from October to May.

St. Louis Ear, Nose and Throat Club

Acting President: Senior member of the executive committee: Dr. Arthur W. Proetz, 3720 Washington Blvd., St. Louis.
Secretary: Dr. B. J. McMahon, 813 Missouri Bldg., St. Louis.
Place: University Club Bldg. Time: Third Wednesday in February, April, October and December.

San Antonio Ophthalmolo-Oto-Laryngological Society

President: Dr. Scott Applewhite, 706 Medical Arts Bldg., San Antonio, Texas.
Secretary-Treasurer: Dr. E. D. Dumas, 425 Medical Arts Bldg., San Antonio, Texas.
Place: Bexar County Medical Library. Time: 8 p. m., first Tuesday of each month from October to May.

San Francisco County Medical Society, Section on Eye, Ear, Nose and Throat

Chairman: Dr. Robert Carson Martin, 384 Post St., San Francisco.
Secretary: Dr. George N. Hosford, 490 Post St., San Francisco.
Place: Society's Building, 2180 Washington St., San Francisco. Time: Third Tuesday of every month except May, June, July and December.

Shreveport Eye, Ear, Nose and Throat Society

President: Dr. J. L. Scales, Medical Arts Bldg., Shreveport, La.
Secretary-Treasurer: Dr. W. L. Atkins, 505 Medical Arts Bldg., Shreveport, La.
Place: 1240 Texas Ave. Time: 7:30 p. m., first Monday of each month from October to June.

Spokane Academy of Ophthalmology and Otolaryngology

President: Dr. Paul A. Remington, Old National Bank Bldg., Spokane, Wash.
Secretary: Dr. Louis A. Parsell, Paulsen Medical and Dental Bldg., Spokane, Wash.
Place: Paulsen Medical and Dental Library. Time: 8 p. m., fourth Tuesday of each month except June, July and August.

Syracuse Eye, Ear, Nose and Throat Society

President: Dr. M. G. Brown, 713 Genesee St., Syracuse, N. Y.
Secretary-Treasurer: Dr. A. Harry Rubenstein, Medical Arts Bldg., Syracuse, N. Y.
Place: University Club. Time: Second Friday of each month except June, July and August.

Tulsa Academy of Ophthalmology and Otolaryngology

President: Dr. Roy W. Dunlap, 108 W. 6th St., Tulsa, Okla.
Secretary-Treasurer: Dr. Marvin D. Henley, 108 W. 6th St., Tulsa, Okla.
Place: Medical Arts Bldg. Time: Monthly.

THE ARCHIVES OF OTOLARYNGOLOGY is published by the American Medical Association to stimulate research in the field of laryngology and otology, and to disseminate knowledge in this department of medicine.

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